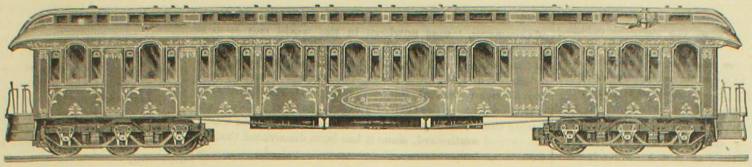
NATIONAL CAR AND LOCOMOTIVE BUILDER.



VOLUME XVIII. NUMBER 4. | APRIL, 1887. | SINGLE NUMBERS, TEN CENTS, $1.00 PER ANNUM.

Miscellaneous Items.

THE New York, Lake Erie & Western Railroad Co. are equipping 1,500 freight cars with McKeen automatic safety couplers.

THE Cleveland, Loraine & Wheeling Railroad Co. are building a lot of Goodwin Dump Cars at the shops of the road, at Lorain, O.

THE Frost light has been put in a car now running between New York and New Haven. The light is remarkably brilliant and very steady.

THE Interstate commerce law is quite clear in one respect. The word "railroad" is used in it eight times, and "railroads" four times, while "railway" and "railways" are not used at all. This is official, and ought to settle the matter.

THE Illinois Central Rail road Co. are building five new baggage cars in their Chicago shops. They are also building three stock cars daily in the same shops, and have ordered twenty new day coaches from Harlan & Hollingsworth, Wilmington, Del.

AMES COUPLERS are being applied on 6,375 freight cars now building, as follows: New York Central, 1,600; Lake Shore, 1,300; Michigan Central, 1,000; Boston & Albany, 1,000; Fall Brook Coal Co., 475; Merchants' Despatch Transportation Co., 1,000.

THE *Age of Steel* says that the car works in the vicinity of St. Louis were perhaps never so busy as at present; not only are they as busy as it is possible to be, but their capacity is covered with contracts for months to come. The two local street car works are also taxed with large orders.

THE Bulletin of the Baltimore & Ohio Employés' Relief Association shows, for the month of January, payments of benefits to members in 946 cases, aggregating $33,397. This includes $9,250 for accidental death, $5,473 for accidental injuries, $7,746 for natural sickness and $9,750 for natural death.

THE Minnesota & Northwestern Railway Co. have ordered some very heavy ten-wheel locomotives, with cylinders 19 × 24 inches, that will be used for pulling heavy fast passenger trains. It looks as if this road was coming to handle its share of the passenger business between Chicago & St. Paul.

THE car-building firm of J. G. Brill & Co., of Philadelphia, has been dissolved and the business transferred to the J. G. Brill Company, with J. G. Brill as President, G. M. Brill as Vice-President and James Rawle as Treasurer. The new company has bought 36 acres of land in Philadelphia, and will erect new buildings there.

TRACK-LAYING on the Colorado Midland is now progressing at the rate of a mile a day, and 25 miles out from Colorado Springs have been graded. At this time six engines are employed in furnishing rails and ties, and 25,000 oak ties have been received recently from Missouri and Indiana. It is expected to have the road in operation by August.

A NEW locomotive has just been turned out at the New York Central shops at West Albany. It is designed for the heavy west passenger train which leaves New York at 6 o'clock P. M., and consists of 12 or 13 cars, 9 or 10 of which are sleepers. The engine is No. 615, has a 53-inch boiler and 18×24 inch cylinders. The train will now be run as a single instead of double header.

A statement attached to the Patent Office report shows that the total number of applications filed during the last calendar year, requiring investigation and action, was 41,442, and the number of patents issued was 23,915. The total receipts were $1,154,551, and the expenditures $992,503, leaving a balance of receipts over expenditures of $162,048. The amount to the credit of the patent fund in the Treasury was $3,107,453.

THE Chicago, Milwaukee & St. Paul Co. have recently finished a new building at West Milwaukee, which has been erected to provide office accommodation for Mr. J. N. Barr, superintendent of the car department. The chemical laboratory is also located upstairs in the same building, and is provided with elaborate conveniences. The car department is very busy with repair work and is building five new mail cars of the road's standard dimensions.

THE Pittsburgh, Cincinnati & St. Louis Railroad is noted for the convenience and ingenuity of its gabarets. Superintendent of motive power Wall invented the name and helped engineer Harrington to design the article. It is used for measuring the height and breadth of cars and their loads. When Harrington first received orders to make a drawing of a gabaret, he thought the thing was connected in some way with jaw, and he was not very far out.

THE Martin system of heating cars was tested on the New York Central a few days ago. The train was composed of one baggage, one smoker and three passenger coaches. On the down trip the device worked satisfactorily. Before the train left for Poughkeepsie the engine was attached to the cars for 50 minutes and steam sent through the pipes. The cars were comfortably warmed, and the temperature was easily controlled. No trouble was experienced with the pipes, but there was a slight leakage from two or three of the joints upon the couplings.

THE new limited train service of the New York Central is to be improved by the addition of some new and extremely luxurious cars, including buffet smoking cars 69 feet long, supplied with movable chairs, a bath-room, barber shop, and library containing the latest novels, newspapers and periodicals. The platforms will be protected by gates and canopies so that passengers can pass from car to car without danger or exposure. The trains will be lighted by electricity, and probably heated by steam. Nothing is said about bowling-alleys and billiards, but it is only a question of time.

A CURIOUS accident happened on a road running out of Cleveland that led to considerable delay with a through passenger train. The engine that was running the train had just been through the shop getting a thorough repair, and she was set up very high on the springs, and a new stack was put on which was also rather aspiring. The fact that the engine held her head too high was not discovered when she was attached to a passenger train, and accordingly she started out bravely till a low bridge was reached, when the stack was knocked off entirely. That road has now determined to erect a gabaret in connection with the repair shops.

WE have received several communications lately from master mechanics of southern railroads which indicate that economy of fuel is watched very closely in locomotive operating, for the mileage run per cord of wood and ton of coal was very high. We have now before us the summary of locomotive performance on the Western & Atlantic Railroad, of which Mr. M. Lamar Collier is master mechanic, which compares very favorably with anything we have yet published, when the total expenses are considered. The whole of the engines on the road averaged over 45 miles to the ton of coal or cord of wood, and the total expenses for supplies, wages, and repairs, was 11.8 cents per mile. Can any one beat this?

THE Decapod locomotives built last year by the Baldwin Locomotive Works for the Northern Pacific Railroad are now at work in construction on the Cascade Mountain division The engines have been a surprise to the mechanical department of the road, owing to the unexpected ease with which they pass round the sharpest curves. They will go anywhere that an eight-wheel engine can go. The switchbacks for crossing the Cascade Mountains are almost finished, and the road will be in operation within two months. The Decapods will then be used for pulling the trains up the steep grades. The tunnel, which will reduce the grades to 116 feet to the mile, the maximum grade used on the Northern Pacific Railroad, will not be completed for two years.

ANYTHING that will promote steady and sober habits among trainmen is certain to have a most beneficial effect upon the roads where such men are employed. Of late years there has been great improvement in the habits of railroad men generally so far as drinking is concerned, but there is still a good deal of reformation to be desired. Nearly all railroad managers and other officers do all in their power to supply attractions that will keep their trainmen away from saloons, but there is still far too much time spent by men whose heads should never be befogged by liquor in drinking saloons. The Chicago & Northwestern Railway is an exemplary road, yet there are something like twenty saloons within half a mile of the mechanical headquarters in the suburbs of Chicago.

A TRAIN of cars just built at the Pullman Works, at Pullman, Ill., will shortly commence running on the Pennsylvania as the New York & Chicago Limited. The train will consist of two or more sleepers, a drawing-room car, a dining car, and a combination baggage and smoking car as at present. A novel and much needed feature is, however, introduced in the new train. Instead of being made up of distinct cars, with open platforms separating them, the train will be virtually one long car. The platforms will be roofed over so as to be weatherproof, and also walled in with wooden partitions, much as the mail cars are to-day. A lady will be able to walk from end to end of the train without the least inconvenience or danger. The train will also embody many improvements in details, while the ornamentation of the cars will be even more elaborate than on the cars at present running on this train.

IN order to prevent railroad corporations from owning and operating coal mines the *American Machinist* suggests that the transportation of so much of the product of the mines as is consumed outside of the State of Pennsylvania should be regarded as Interstate commerce subject to regulation by Congress, and that a federal law should be passed prohibiting persons interested in mining coal to be shipped over railroads doing an Interstate business from serving as officers or directors of such roads. This, as it seems to us, would not reach the core of the matter. It would only check or partially check the alleged abuses growing out of the union of mining and transportation interests. A law simply prohibiting railroad companies from owning any more land than right of way and what is necessary for stations, shops and track-yards, does not prevent the purchase of such land or the passing of a valid title. So far as its object is concerned, such a law is simply nugatory or no law. There should, of course, be some adequate restraining penalty, or let the legislature enact that the title to land so purchased shall be void.

A WEAK point in the Thielsen freight car truck is the bolts that secure the arch-bars. Drilling holes for the bolts weakens the bars so much that breakage of bars is common. Instead of adopting what is obviously the sound mechanical policy of strengthening the bars to make them sufficiently strong when drilled, some roads have made the bolts in the form of a staple that spans both bars. This is a very clumsy and crude way of putting work together, and, as might be expected, experience shows that the plan fails to keep the bars in place, and tends to let the truck get out of square. Some roads are adopting the plan of punching the holes in arch-bars and other parts of iron trucks. We believe that this is one of the economical methods of doing work likely to prove very costly in the long run. If an iron truck is to be made durable, care ought to be taken in making the holes match, and that cannot be done by punching. The cheap methods of construction are likely to do more to bring iron trucks into disrepute than any influence that can be brought against them, and they have to encounter many adverse influences.

PUBLIC interest in the car heating question has become so great that it is not likely to subside very much even should the coming summer be a long and hot one. "The car stove must go," has become a war-cry all over the land, and if "steam from the locomotive" does not find its way into a great many passenger cars before the ides of November, it will not be for lack of appliances and systems to get it there. This method has seemed all along to be the only alternative if no fire except for lighting is to be carried inside or underneath the cars. But the progress of invention, under the stimulus of a pressing need, has, it seems, discovered a way by which cars can be warmed by heat conveyed from the engine in pipes, as air is for the air brakes, but without using any steam. Mr. George A. Deitz, of Chambersburg, Pa., is the inventor of this plan, and proposes to heat cars with it so as to make them absolutely safe from fire in case of accident. How the heat is made is a secret known only to Mr. Deitz, but he claims that it can be produced at less than half the expense of the ordinary dangerous methods. So says a local paper printed in the above named town. It also says that Mr. Deitz has invented a car door lock and fastener, and has given to both inventions years of study. We advise him, however, to harbor no secrets in the matter of heating cars. Everything must be free, open and above board, or his fate will be like Keely's.

The Laws of Friction.

1. Friction is greatly influenced by the smoothness or roughness, hardness or softness of the surfaces rubbing against each other.

2. It is in proportion to the pressure, or load; that is, a double pressure will produce a double amount of friction, and so of any other proportionate increase of the load.

3. The friction does not depend upon the extent of surface, the weight of body remaining the same.

4. The friction is greater after the bodies have been allowed to remain for some time at rest in contact with each other than when they are first so placed ; as for example, a wheel turning upon gudgeons will require a greater weight to start it after remaining some hours at rest that it would at first. The cause of this appears to be that the minute asperities which exist even upon the smoothest bodies gradually sink into theopposite spaces and thus hold upon each other. It is for the same reason that a greater force is required to set a body in motion than to keep it in motion. If about one-third the amount of a weight be required to move that weight along in the first instance, one-fourth will keep it in motion.

5. The friction of axles does not at all depend upon their velocity ; thus, a railroad car traveling at the rate of twenty miles an hour will not have been retarded by friction more than another which travels only ten miles in that time. It appears, therefore, from the last three laws that the amount of friction is as the pressure directly, without regard to surface, time or velocity.

6. Friction is greatly diminished by unguents, and this diminution is as the nature of the unguents, without references to the substance moving over them. The kind of unguent which ought to be employed depends principally upon the load ; it ought to suffice just to prevent the bodies from coming into contact with each other. The lighter the weight, therefore, the finer and more fluid the unguent should be, and vice versa.

Railroad Reading Rooms.

We consider there are few better paying investments made by railroad companies than that of putting money into reading rooms and for the support of branches of the Young Men's Christian Association for the use of their employés. The practice has been followed extensively only by the best managed roads, but the returns for good are so indisputable that others are following the example. Although working in a humble way in poor rooms badly situated, one of the most successful branches of the railroad section of the Young Men's Christian Association in the West has been the rooms at the corner of Kinzie and Canal streets, in Chicago. From a report recently issued by Mr. W. Cook, the hard working secretary, we learn that during the last eight years the total attendance at the rooms has been 213,566. Lectures, gospel meetings and various kinds of entertainments are held in the rooms as often as possible, and they are very well attended. The rooms contain a small library, which is entirely inadequate to the demands for reading made by the railroad men. Facilities are provided for writing letters, and there is a good selection of newspapers, magazines and other reading matter. Chess, checkers, and various other games can be played in the rooms. Any one having books to spare might feel assured that he would be putting them to good use by donating them to these rooms.

The Goodell Dry Air Refrigerator Car.

These cars are meeting with a success on Western roads, where they are used, that must be highly gratifying to every one who is interested in this system of refrigeration. In his description of the arrangement of the car, Mr. Goodell says :

"Its construction is based upon the principle of natural laws of gravitation and heat and cold—as cold air descends warm air ascends.

"The Ice Box extends the entire length of the car and rests upon joists arranged across the car, properly supported, the floor of which is sloped slightly from the center to the sides, to afford ready drainage, and that the outflow of cold air may be as low as possible; also, in order that the central opening for the ascent of the warm air may be as high as possible. The cold air has a clear opening of FIVE INCHES from the ice, on each side, the entire length, to descend to the body of the car; and the warm air has a central clear opening of SIX INCHES, wherein to ascend to the highest point, where it divides and has over three inches, on both sides (at the top) of the central opening, to pass between the car-lines directly on to the ice, where it is condensed (*and all impurities are absorbed by the meltage*), thus creating a constant current of dry, pure air, avoiding all condensation and moisture unavoidable without a free circulation.

"There are some points necessary to be attained in constructing Refrigerator Cars :

"*First*—The holding of the ice compactly and in convenient position within the car.

"*Second*—To expose as much as possible of refrigerating surface to the air.

"*Third*—To provide a suitable system of drainage.

"*Fourth*—To provide the most efficient and active circulation of the air from the ice to the center or body of the car.

"*Fifth*—To economize and provide the largest possible amount of room for the suspension of meats and the like.

"The drainage from the car is as free as from the roof of a house. It will readily be seen the car must work quick and constantly, as the radiation of cold air is from a large surface of ice—some hundreds of feet.

"Good insulation, thorough circulation, and perfect drainage are the requisites of good refrigeration, and this car possesses all these qualities, as can be shown."

The Scenery of Our Own Continent.

"It is safe to say," says a writer in the Chicago *Journa of Commerce*, "that nowhere in the world can such a stretch of magnificent scenery be enjoyed in a single trip as that between El Poso, in Western Texas, and Vera Cruz, a distance of 1,487 miles in one consecutive journey over the Mexican Central Railroad and the Mexican Railway, which connect at the City of Mexico. It is no wonder that during the last two years the great tide of American travel has turned southward, since it has been discovered that it would be folly to cross the ocean in search of antiquities that are as yesterday to the wonders of our own continent, to climb mountains that to ours are as mole-hills, or to find national customs not more curious and scenery less grand and beautiful. The railroads have unlocked the treasure-houses of nature and thrown wide the portals of the past. In a week of luxurious and comparatively inexpensive travel the tourist may go by palace car from New York, Chicago, or any other Northern city, without toil, hardship or the dangers of the ocean. He may see Egypt, Palestine and old Spain illustrated on our own continent ; may revel in the exuberance of the tropics, breathing the health-giving air of elevated plateaus, and gaze upon the most majestic scenery the world can show. The route leads through cities that were old when the pilgrim fathers landed on Plymouth Rock—some of them at elevations higher than the top of Mount Washington; climbing dizzy heights to wild fastnesses of the mountain, and descending to tropical valleys where eternal summer reigns."

Railroading Under Difficulties. How a Horse Stopped the Operation of a Road.

The city of Smithville, Missouri, was languishing because it had no natural resources for the building up of anything larger than an agricultural trading post, and the people believed that the depression in business was owing to the lack of railroad competition. The main line of the Great Morning Sun Route passed through Smithville, but the Smithvillites were not satisfied. The people remembered with bitterness and rage that the agents who secured the right of way through Smithville, had promised that, in case the right of way was granted, the road would build up the city until it would become a dangerous rival of St. Louis. But they failed to see that the other road had done anything to increase the demand for groceries or dry goods, and in their righteous indignation they were willing to turn over their patronage to a rival corporation.

When the heart of a community is stirred to the core with ambition or revenge, something important is likely to happen. The Smithvillites arose in their might, assembled themselves in mass meetings, and poured forth much high pressure wrath against their enemies, directing the stream straight in the face of all corporations, but particularly against railroad corporations as represented by the Morning Sun Route. Committees were appointed to devise means of relief, and the whole influence of Smithville was pledged to support any schemes which, to quote the words of a resolution, "are calculated to mitigate the despotism or lighten the burdens under which the industries of the city are groaning."

How it came to pass I cannot tell, but one of these committees induced my uncle, the Receiver of the St. Louis, Western & Moribund Railroad, to finish and put in operation a part of the great transcontinental railroad, of which the United States Court had appointed him custodian, lying between Smithville and the Evening Star Through Railroad. By going ten miles in the wrong direction, the citizens of Smithville were thus to obtain for themselves and their goods what was described as a new and direct route to Eastern markets. The connection was duly built, and if laying down worn out iron on the poorest kind of a roadbed, without surfacing or gravel, may be called finishing, the structure was finished. At this time I took part in the fortunes of the road.

Railroading always had great attractions for me, but till the opening of the Smithville extension, fortune had confined me to the prosaic drudgery of retailing red herrings, molasses and other sundries at a grocery store in a small Missouri town. At my earnest solicitation, my uncle appointed me general superintendent of the new railroad which the Smithville people with ungrateful levity called "The Plug." My charge, the finished portion of the St. Louis, Western & Moribund Railroad, was ten miles long, and was operated by two trains run each way daily. We did not make ostentatious pretentions as railroad men. All the building we had was an old box car body, which was used as passenger depot at Smithville. For rolling stock we had a combined coach and baggage car that the Evening Star route had found unsafe for their through trains, and an old locomotive which the boys in the neighborhood called the "Mud Turtle," owing to some supposed similarity in appearance or habits. There was no engine-house, no tools of any kind, no water tank, no turn-table. In fact, there was nothing superfluous or useful beyond the track, the car and the bare locomotive. As there were no office duties to perform, and as the road could not support idle men, I made myself a good example by performing the duties of conductor and brakeman. In fact, there were only three trainmen, myself, the engineer and fireman. We were a happy family and helped each other along. When a farmer stopped the train anywhere to take on a load of potatoes, the engineer and fireman would come back and help to load the produce into the car, and when they stopped at a woodpile to get fuel to keep the locomotive going, I would regularly help them with the wood. This familiarity all round was not without its inconveniences, for the farmers would stop the cars anywhere or at any time to ask how the price of hogs was, or whether it would be best to send their butter to Smithville or Rentsell, a city of twelve hundred inhabitants in the opposite direction.

Of course the track was not fenced, and there was no need for anything of the kind to protect stock from the danger of being struck by the locomotive. No danger of that kind existed, for the speed was always regulated to give the stupidest animal time to get out of the way. This method of operating was deliberately arranged, for it was well understood that the striking of a horse or the killing of a cow would entail paying for the animal, an expenditure that would seriously embarrass the Receiver's financial resources. Yet, in spite of all precautions, an accident happened which not only put tremendous tension upon the financial resources of the road, but threatened for a time indefinitely to suspend operations through obstructing the track.

Near Smithville a high trestle was used as a means of crossing a high defile. The ends of the trestle were in a pasture where cattle and horses roamed heedless of the track. The engine and car had passed through this pasture daily for several months, and the animals had grown so much accustomed to the train that there sometimes was difficulty in getting them to keep away from the engine's cow-catcher. One day the side track at the junction, which we used for switching purposes, was so deeply sunk in the mud that we could not use it, and thought it the safer plan to return to Smithville, pushing the car in front of the engine. We got along in this way without any mishap till we reached the pasture referred to, when a sudden panic seemed to seize the animals as they caught sight of the unusual spectacle of the car being pushed in front of the engine. One young horse was so frightened that he ran on to the trestle, and after passing over about thirty feet on the ties, fell down with his legs dangling through. The train was stopped readily enough, but when we went on to the trestle and tried to get the horse out, we found he was stuck fast. The passengers came out and helped with hands and suggestions—especially the latter—but lift the horse we could not, and I was afraid to have him pulled round much lest he might fall off the trestle and break his neck. The suggestion was made by the engineer that he borrow an axe somewhere and chop the ties so that the horse could fall through, but I knew the road could not bear any such expense. I told the passengers that the train was abandoned and that they might walk to Smithville, which was only three miles away. Some of them growled and others were abusive, but I was master of the situation and meant to save that horse and lift him up, too, if I had to send to St. Louis for a derrick to do the work. The engineer, who had more experience of these things than I had, said if I could get a block and fall in Smithville, and a telegraph pole, he would get the horse out safely. I could see no better way, so I adopted the engineer's plan, but when I went to Smithville and searched for a block and fall I found there was no such thing in the city. After a long search I discovered that a man in a town about eight miles away, who did house moving, possessed the articles I required. There apparently being no better way out of the difficulty, I hired a horse and drove out to where the man lived. I found him and had no difficulty in bargaining for the use of the tackle, so I returned to Smithville in triumph. By this time it was dark and nothing could be done till morning. Bright and early I got out to the trestle in the morning and founnd things in *status quo*. The horse was still lying helpless with his legs hanging between the ties, and the engine was waiting to get past.

We proceeded with the least possible delay to prepare for lifting the animal out and so clear the track. The block and fall was attached to a telegraph pole secured to the trestle. Before we began raising the animal up, I thought it would be a good plan to get planks slipped under the horse so that he would get solid footing as soon as we got him raised up, so I directed my assistants to try and get the planks pushed into the proper position. They had got one in all right and were working the other under, when the horse began struggling. Just how it happened I never could make out, but before we could do anything to secure him, the horse was on his feet, and in another instant was tumbling over the side of the trestle. He went down twenty-six feet and broke two of his legs.

I had done the best that was possible to save the road from loss, but my efforts were not appreciated. My uncle, the Receiver, happened to visit Smithville two days afterwards, and some of the passengers who were delayed gave their version of the affair before I met him. I am not general superintendent any longer, in fact I am a freight brakeman on the Missouri Pacific, where I exerted so much influence on the side of order during the strikes of last summer that I expect soon to be promoted.

SAM RARUS.

Steam and Motive Power.

BY ANGUS SINCLAIR.

MECHANICAL EQUIVALENT OF HEAT.

Steam, the vapor of water, is the most convenient medium known for transforming heat, the potential energy of fuel, into mechanical work. The operation is usually carried on by means of the steam engine. According to the laws of thermodynamics, which are accepted as the gospel of steam engineering, heat and mechanical energy are mutually convertible; and heat requires for its production and produces by its disappearance mechanical energy in the proportion of 772 foot-pounds for each unit of heat. That factor, 772, is known as Joules mechanical equivalent of heat. The thermal or heat unit is the quantity of heat required to raise the temperature of one pound of water one degree Fahrenheit at a temperature slightly above the freezing point. As water increases in temperature, a slightly larger quantity of heat is required to raise the temperature one degree, owing to the expansion of the water and consequent disappearance of heat in doing internal and external work. At 400 degrees Fah. the dynamical or work value of one degree is 800 foot-pounds. This fact should be borne in mind by engineers experimenting with high-pressures of steam.

In most calculations relating to heat, engineers and scientists employ the heat unit as a basis of measurement. In ordinary engineering operations, the heat required to raise the temperature of one pound of water one degree at any temperature is calculated as a heat unit.

WORK OF CONVERTING WATER INTO STEAM.

As a convenient means of noting the phenomena connected with the mechanical power developed by the converson of water into steam, suppose we place one pound of water at the freezing point in a vessel convenient for measurement, and, applying heat, follow, observe, and record the events of a cycle similar to that which steam makes in passing through the boiler and cylinders of a steam engine. Let us place the water at a temperature of 32° Fah. at the bottom of a glass tube of indefinite length, open at the top, and having a cross sectional area of one square foot—144 square inches. At the freezing point one pound of water measures 27.7 cubic inches, therefore the volume we are going to experiment with will cover the level bottom of the tube to a depth of .1923 inch. If now we apply the flame of a spirit lamp or other source of regular heat to the tube beneath the water, the temperature will begin steadily to rise until 212° Fah., the boiling point at atmospheric pressure, is reached. The water will then be gradually evaporated into steam, but the temperature will remain the same until vaporization is completed. If it took ten minutes for the heat of the lamp flame to raise the temperature of the water from 32° Fah., the freezing point, to 212° Fah., the boiling point, it would take nearly fifty-five minutes longer before the whole of the water would be converted into steam, and the thermometer would indicate no elevation of temperature for the great additional amount of heat expended. It takes nearly 5½ times the quantity of heat to evaporate one pound of water—or any other weight for that matter—that it takes to raise the same quantity from the freezing to the boiling point, and the great expenditure of heat is not sensible to the thermometer.

LATENT HEAT.

Philosophers have been accustomed to explain the disappearance of heat by saying that it became "latent" in the steam. The expression is ambiguous, and has led to much misapprehension of what really becomes of the heat when water is converted into steam. Physicists now give a more detailed explanation of the phenomenon.

There are certain exceedingly powerful molecular forces called chemical affinity and cohesion exerted by nature upon water tending to condensation, attracting the atoms into a close tenacious embrace. The application of sufficient heat will have the effect of performing the internal work necessary to overcome the attraction of the atoms, a change of condition will be accomplished, and the water will be expanded into steam. The heat applied will do the work of tearing the atoms apart and in keeping them for a time in that condition. Still further application of heat under proper conditions would have the effect of separating the constituent gases of water. The process of expansion into steam is obstructed by outside resistance, principally by that presented by the pressure of the atmosphere. The work performed against the latter influences is called external work.

HEAT OF VAPORIZATION.

When the heat was applied beneath our tube the power of the flame was first devoted to raising the temperature of the water, and 180 heat units were expended in this manner augmenting the temperature from 32° to 212° Fah. The heat continues to pass into the water and steam is gradually formed, boiling goes on, and when the last drop of the water has been evaporated, 966 heat units, besides that used to heat the water, have been expended, making a total of 1,146 heat units which is known as the total heat of vaporization. The degree of heat that has been insensible to the thermometer, viz., 966 heat units, is often spoken of as the latent heat of steam at atmospheric pressure.

SATURATED STEAM.

The steam formed in the way described, where only sufficient heat is applied to evaporate the water, has a certain density and pressure corresponding to the temperature. In such condition the steam is said to be saturated, being incapable of vaporizing more water into the same space without increase of temperature. Saturated steam contains just sufficient heat to maintain the vaporous condition, and the smallest abstraction of heat results in a portion of the steam returning into the condition of water, when it loses its capacity for doing work. In all good boilers where the steam is held in contact with water, it is used in the saturated condition. When boilers are of defective design, or where rapid forcing is resorted to in generating steam, water in the form of spray passes off along with the steam and causes great loss of heat, besides endangering the machinery from the pressure of the inelastic water in the cylinders. But when water is passed out of the boiler in this way, without receiving the heat required for evaporation, it is sometimes made to show that the boiler evaporates a large quantity of water to the pound of coal burned. Of course it will be perceived that only the heat sensible to the thermometer has been put into the water that passes over in the form of spray, the minute particles of the water being carried by the lighter steam. Saturated steam is also known as dry and anhydrous steam.

SUPERHEATED STEAM.

If we had continued the heat under our tube after all the water was evaporated, the steam would have received more heat than what was necessary to evaporate it from water, and it would become superheated. Superheated steam is valuable when it can be obtained conveniently, because it contains heat that can be parted with before condensation ensues. When saturated steam is expanded without meeting resistance, as in throttling, it is slightly superheated. That is, the heat due to a high pressure remains in the steam at a lower pressure. The first effect of imparting additional heat to saturated steam is analagous to the effect of applying heat to water, but the work is done to convert the vapor of steam into a perfect gas. When this is completed the heat goes to increase the temperature and to perform internal work. If the application of heat is continued to the required rise of temperature, the gas of water will be dissociated into the original elements of oxygen and hydrogen.

RELATIVE VOLUMES OF WATER AND STEAM.

The steam formed by our process of evaporation occupies 1,644 times the space which held the water, that being the relative volumes of water and steam at atmospheric pressure. According to what is known as Marriotte's law, a perfect gas, that is a fluid, in which all internal forces have been overcome, expands so that the volume varies inversely with the pressure. Steam is not a perfect gas, but it follows the law referred to close enough for practical purposes. A pressure of two atmospheres would therefore reduce the volume of our steam one-half, and maintain it at double the pressure. But we will return to the experiment of steam being formed under one atmosphere.

Our tube being one foot square in area, 144 square inches, the steam forms a column 26.36 feet high. In taking possession of this length of tube the steam had to work up against the atmospheric pressure of 14.7 pounds to the square inch. The weight of the atmosphere presses upon the surface of the boiling water like an invisible piston, and the weight had to be lifted before the steam could rise. So in rising, the steam raises a weight equivalent to $14.7 \times 144 = 2,116.8$ pounds. Raising this through 26.36 feet amounts to 55,798 foot-pounds of external work done during the evaporation of one pound of water at atmospheric pressure.

WORK REPRESENTED BY THE HEAT EXPENDED.

We are now in a position to account for all the heat expended and show its equivalent in work or stored energy. In the first place, 180 heat units were employed in raising the temperature of the water to the boiling point, which amounts to $180 \times 772 = 138,960$ foot-pounds. Then 966 heat units, the so-called latent heat of steam, were expended before evaporation was completed, making 745,752 foot-pounds put into the steam and insensible to the thermometer. We have seen that 55,798 foot-pounds of this aggregation were expended overcoming atmospheric resistance—doing external work—leaving 689,954 foot-pounds as the mechanical equivalent of the heat used in forcing the water apart, overcoming the internal forces of attraction, and holding the atoms of the steam apart. The work done is analogous to the operation of raising the weight of a great hammer or pile driver, and holding it in position ready for a blow. The whole of the heat energy put into the water, except what is expended in overcoming external resistance, viz., 828,914 foot-pounds represented by the latent heat in the steam, and the 138,960 foot-pounds represented by the heat expended in raising the temperature of the water, are available for passing into a condenser or to perform mechanical work.

Or, if the pound of steam were returned into water at a temperature of 32°, it would be found capable of raising to the boiling point nearly 5½ pounds of water, the only loss of heat being the quantity used in overcoming the pressure of the atmosphere.

A striking feature perceived in the operation of turning the steam back into water, is the small loss of heat that occurs. Of the 1,146 total heat units expended, 1,074 units are available for returning into the water and heating it, an efficiency of 94 per cent. It may be interesting to ascertain why the column of steam falls so far short in efficiency for doing work when applied to the steam engine.

STEAM UNDER HEAVY PRESSURE.

As the low tension of steam employed in our example would be useless for any purpose connected with railroad motive power, we will take up a case of generating steam at a pressure familiar to those engaged in railroad engineering. Suppose we again put in our tube a pound of water at a temperature of 32° Fah. and apply heat. Instead of leaving the tube open to the atmosphere, we will put a piston weighing 130.3 pounds to the square inch on the surface of the water, and we will further suppose that the piston will be perfectly steam tight and capable of moving upward with no friction. As the atmospheric pressure will rest upon the upper side of the piston, steam can not be formed without raising an absolute load of 145 pounds to the square inch.

BOILING POINT RISES WITH INCREASE OF PRESSURE.

On heat being now applied, the temperature of the water will keep rising until the thermometer registers 355.6° Fah., at which point boiling will begin. This fact we may be assured of, although no thermometer is used, if the pressure be maintained. For the knowledge of this and a great many other interesting and important particulars about heat and steam, the engineering world is indebted to Regnault, a distinguished French physicist. Heat continuing to pass into the water, boiling will go on, steam will be formed and the piston raised till the last drop of water is evaporated. When this operation is completed, it will be found that 866.8 heat units beyond that used to raise the temperature of the water to the boiling point have been expended in turning the water into steam. Reckoned from the freezing point, the total heat of vaporization would in this case be 1,190.4 heat units, as compared with 1,146 heat units when evaporation was performed at atmospheric pressure. The volume now occupied by the steam is 192 times greater than the space which held the pound of water, and the piston with its total load, 145 pounds $\times$ 144 inches = 20,880 pounds, has been raised 3.0777 feet, doing external work equal to 64,262 foot-pounds, representing 83.24 heat units.

When the quantity of heat expended in overcoming external resistance is deducted from the total heat of vaporization, it will be found that 1,106.16 heat units, or 853,955 foot-pounds, have been elevated to an altitude convenient for doing work.

The calculations made in connection with evaporating one pound of water in a tube, apply to the ordinary process followed of evaporating water in steam boilers.

We have taken no account of the loss of heat that occurs in the furnace.

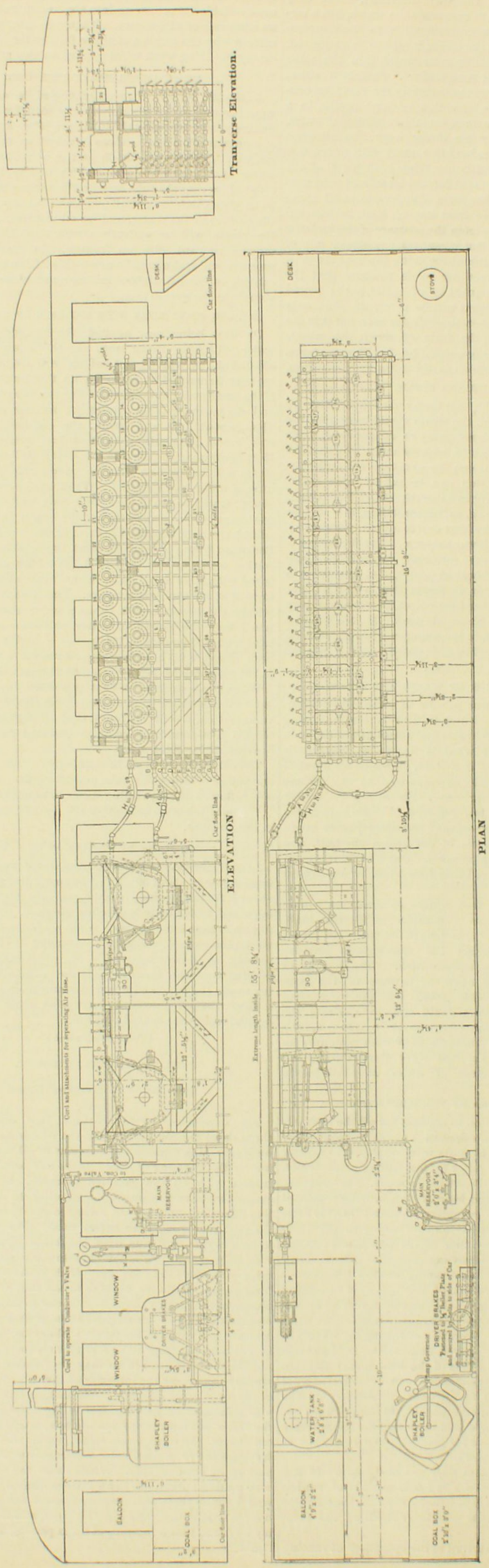
DOING WORK BY EXPANSION OF STEAM.

In ordinary railroad practice the steam would be raised from water at about 50° Fah. temperature, so that only about 1,172 heat units would be put into the work of raising steam to 145 pounds absolute pressure. Of this quantity 83.24 heat units are lost, so far as being returned into work is concerned, since the heat energy has been used up already in doing the work of overcoming external resistance. The economy of the engine that is going to use the pound of steam depends upon its capability to lower the temperature by expansion while doing work against resistance behind a piston.

(To be continued.)

Hot Brine in Heating Pipes.

The unusually severe weather that has prevailed throughout the country during the winter has tried in a most searching manner the capacity of all the methods in use for the warming of cars. There has been more or less trouble with all the patented methods. In several instances we have encountered cars using the hot brine system that were out of order owing to the blowing out of the mixture through the safety valve. We have reason to believe that difficulty with the brine heating process results from the injection of air into pipes along with the brine. Parties filling the pipes with brine by means of a force-pump should be careful to see that no air leakage occurs in the suction pipe. It is better to have the vessel containing the non-freezing solution placed so that the mixture will run into the pump without suction. A leak in a suction pipe may be so trifling that the workman will not detect it, yet enough air may be passing in at each stroke to endanger the integrity of the coil. The tendency of the air is to accumulate in one spot, and if a considerable volume of air gets together in the coil, it will keep the water mixture away from the hot part, so that burning out ensues. In other cases steam mixes with the air and increases the pressure till the safety valves are raised and part of the brine escapes. Where cases are happening of coils getting burned out in an unaccountable manner, we would advise those concerned to inspect the means they use for forcing the brine into the pipes, and it will probably be found that a mixture of air is passing in with the liquid.



UNION PACIFIC RAILWAY INSTRUCTION CAR FOR OPERATING AUTOMATIC AIR BRAKES.

Our engravings give an elevation, plan, and transverse section of a car built and equipped by the Union Pacific Railway Company for instruction of their employés in the operating of automatic air brakes. As this company are rapidly equipping all their rolling stock with the automatic air brake, the importance of having all trainmen familiar with the construction of all details of the brake are obvious. Writing to us on the subject of this car, Mr. Clem. Hackney, superintendent of motive power says: "You will notice that it is arranged to illustrate the working of a train of 30 freight cars. It also shows arrangement of brake with levers, etc., as used in practice on a freight car; it also shows arrangement for driver brakes; and it displays brake cylinder and air reservoir cut in section to expose interior of same; also triple valve and engineers' valve exposed in the same manner. I took every pains to have everything put into the car, and to have the illustrations made in such a clear manner that there should be no misunderstanding, and I find great benefits result from its use. I think the blue print and notes will give all explanations necessary."

New England Railroad Club.

The regular meeting was held on Wednesday evening, March 9, President Marden in the chair.

This being the fourth annual meeting, the annual reports of the Treasurer and Secretary were read, accepted and placed on file.

The report of the Secretary showed the present membership to be 176, and the average attendance the past year 113, a gain of 26 over the previous year.

Mr. Adams, Chairman of the nominating committee appointed at the last meeting, reported the following names of officers nominated for the ensuing year: President, J. N. Lauder; Vice-President, George Richards; Secretary-Treasurer, F. M. Curtis. These officers, together with executive and finance committees, were unanimously elected.

The President announced as the subject for discussion the

LIGHTING AND VENTILATING OF PASSENGERS CARS.

A communication from Mr. J. M. Foster, of Philadelphia, was read, describing his system of lighting cars by compressed gas.

A recess was then taken to allow the members to inspect car No. 90, of the Boston & Albany road, lighted by the Julien electric system.

Mr. Fowler then described the Julien storage battery system of lighting cars. This form of battery is also used on a street car motor on the Eighth Avenue road, New York. The plates or grids in the battery are composed of an alloy which can not be corroded by sulphuric acid. Their standard battery consists of 19 cells and weighs 27 lbs. They claim one cell will run four lamps in a car. This size is in use in the car we have just seen. Six to seven hours is required to charge one of these batteries; but I should put it at 20 to 25 minutes, for the reason that they claim that the economy of the system for driving street cars lies in the fact that they can use the same plant for electric lighting that they use during the day for these batteries. The batteries are charged in the same way that the ordinary current is driven through a wire; they consist of grids lined with red and white oxide of lead, and then filled with sulphuric acid.

Mr. Read: Each cell weighs 27½ lbs. The current used is practically 25 ampères.

Mr. Marden: How long would it take to charge a storage battery capable of giving 10 lights for 10 hours' use?

Mr. Read: It would depend altogether upon the resistance of the lamps and the current that would be used by each lamp. Car 90 can be charged in 5 hours, to run 10 hours. Fifty cars can be charged simultaneously. A car can be elaborately fitted for $900. The cells cost $13 each, and the fixtures $2 each. The current can be taken from any dynamo by a proper arrangement of cells. The weight per car is about 800 lbs. The fixtures are practically permanent, the lamps are guaranteed to last 600 or 700 hours, and the batteries two years. If the railroad owned the plant the cost would be small. Fusible plugs that will melt if the current is too strong are used. A twenty-light or 2,000-candle-power dynamo could charge 200 cells, or a train of twelve cars at one time. The loss by leakage is 20 to 25 per cent. if the cars are left standing from three days to a week. If the cars are used immediately after charging, the loss is 15 per cent. The grids are made of lead, with some antimony to give mechanical stiffness, and a little mercury to prevent the lead oxidizing. If the cars can not stand long enough to have the batteries recharged, the exhausted batteries must be removed and others substituted, thus materially increasing the expense. Sixty cells are required per car, and 2.2 volts per cell.

Mr. Howard described the well-known Pintsch lighting system and added that a new safety cock had lately been added which will shut off the connection between the reservoir and the car in case of collision. Within a few days his company had received an order for lighting 20 more cars for the New York, Lake Erie & Western. It is also used by the New York, Providence & Boston.

Mr. Dixon, of the Pintsch Co., said: Our regulator will control the pressure, without the least touching or adjusting. We put it under the car out of reach. The only pipe in our car is the one that goes through the saloon, and there is only a pressure of one ounce per square inch in that pipe. All the other pipes are under the car or on the roof. The cost of equipping a car with four lamps and a receptacle for gas for 10 hours consumption is about $175. A car can be charged to run 40 hours without recharging. The cost of the plant for supplying a few cars is expensive. A plant which would supply 40 to 60 cars would cost about $4,500, and a plant for supplying 500 cars would cost about $12,000, exclusive of the land, about $25 per car. Every thing used in our apparatus is of the best quality. The lamps are arranged to turn off with a special key, so no one can tamper with them.

Mr. Wise, of South Framingham, said: Since my first patent was granted in 1878, I have used in trains fan-blowers, and I drive them as high as 4,500 turns a minute. They are very simple. I will put in a dynamo, with fan-blower to run it, that will not weigh over 400 lbs., and that can be contained in a box 3 by 2 ft., and if you will give me steam enough to heat your car, at a pressure of 60 lbs., I will give you your lights during the heating season for nothing. I can run my machine by the hot steam from

the boiler, and take the exhaust steam and put it into heating pipes, and it is as good as when it came from the boiler. I will equip a car for $500. I run the dynamo at high speed. I shall have my machine ready to exhibit in two weeks. I can furnish a light with my dynamo equal to any three of the lights in the car exhibits to-night. I want to drive my machine to 2,500 turns, with a pressure of 60 lbs. I will keep the machine in order for $5 a year, if properly oiled. I have it running at the mahogany works in Chelsea, were two have been running five years, and they have never cost him a cent since they commenced to run. If it is required to ventilate a car, I can put in a machine powerful enough, and put a vacuum fan on one side of it, and secure the ventilation. A dynamo can be used on every car if desired, or one can be placed in the baggage car, and serve the whole train. About five horse-power will run a dynamo to light ten cars.

The President: This car on the Boston & Albany has 24 lights. If it takes a horse-power for six lights, it would require four horse-powers for 24. I don't think you could spare steam enough to drive a 40 horse-power machine and haul the train.

Mr. Wise: That amount of steam is not required. I will light sixteen 16 candle-power incandescent lights with one horse-power, for I have done it.

The President congratulated the club on the information obtained, and said the high cost of lighting by electricity by the present systems will delay their introduction, and we have no exact data as to how much it will cost to light a car per hour. I presume the experimental car on the Boston & Albany road will furnish data that will be valuable in the future, but the present enormous cost will prevent most roads from attempting to use it.

The subject will be continued at the next meeting.

Western Railway Club.

There was a large attendance of railroad men and others at the meeting of the Western Railway Club held on March 16. President Scott occupied the chair.

HEIGHT OF DRAW-BARS.

Mr. G. W. Rhodes, Chicago, Burlington & Quincy, chairman of the committee appointed to investigate how far railroads had complied with the standard adopted by the Master Car-Builders' Association respecting uniform height of draw-bars, submitted a report. The committee were in communication with all the roads having representative members in the Master Car-Builders' Association, and tried to ascertain the height of draw-bars on all cars. Great interest in the subject was displayed, for out of 81 inquiries only 6 failed to answer. A statement made up from the information supplied gives the following summary:

No. of railroads or systems of railroads represented in the Association.	Height of draw-bar empty. inches.	Cars represented.	Per cent. of total number of cars.
1	30	3,054	0.58
3	32	3 945	0.75
35	33	218,690	41.95
4	33½	62,874	12.06
17	34	94,968	18.21
1	34½	11 996	2.30
9	35	77,802	11.09
1	35½	48,000	9.20
71		521 329	96.14

It will be seen from the above that the height of draw-bars for freight cars adopted at the fifth Annual Convention of the Association, viz.: 33 inches, when the car is empty, has been more generally adopted than is generally supposed. The Committee were G. W. Rhodes, J. N. Barr, and J. G. Riley.

CAR HEATING

Being the first subject for discussion, was introduced by Mr. Wm. Forsyth, Chicago, Burlington & Quincy, who wished first to indicate the line of invention he thought was most likely to prove successful. The more the subject is discussed the more tendency there is to diversity of views, and he considered it the duty of this club to lead inventors and others into the way of narrowing down their ideas. He favored classifying heaters into two systems. On one side, all heaters, whether steam, hot water or air, which are placed in the car or attached to it. On the other side, heating derived from the locomotive or other single source, which may be termed continuous heating. He favored the continuous system of heating because he did not believe in half measures. Was opposed to all means proposed to make stoves safe, because they would not be safe; and to all automatic methods for extinguishing stoves, because they would not be in working order when wanted. But he had no objection to the use of stoves to warm cars when they were not running. Of the objection urged against continuous system of heating on account of expense, he thought that it would really prove economical. The expense which some of the recent accidents have caused the companies would be sufficient to equip almost any road with a complete system of steam heating. Continuous heating is really an economical system in the matter of fuel. There is very little data as to how much coal is used in heating cars by the locomotive or even by stoves. They had made some experiments to find how much coal was used by the Searle, Baker, and Westinghouse heaters, and found they used on an average about 200 pounds of anthracite coal per car per day. Some of them used even more than that. If we take a day as ten hours, that would be at the rate of 20 pounds per car per hour. On our Chicago divisions we have about five trains a day which average ten cars each, and a number of other trains which make the equivalent of fifteen ten-car trains per day. The total amount of anthracite coal used during a winter of 150 days, would be 2,250 tons, which, at $6 a ton, would cost $13,500. Now in continuous heating I calculate that 50 pounds of water will be used per car per hour. Taking the evaporation of water with our poor Western coal to be as low as 5 pounds of water per pound of coal, we have 10 pounds of soft coal per hour used in heating each car. For the fifteen ten-car trains during the winter of 150 days we require 1,125 tons of coal, which, at $2 a ton, would amount to $11,250, giving a saving of $11,250 annually for one division. To burn this additional 100 pounds of coal per hour in the locomotive, he estimated that only one additional square foot of grate area would be required, and 50 square feet more heating surface, or about the area of eight tubes. He believed that most of the locomotives in use could supply the steam required for heating short trains, and for heavier trains favored the designing and construction of engines with heating surface sufficient to meet the new requirements; thought carbonic acid might be employed to extinguish fires of dining cars in case of accident, but wanted fire in no other cars; thought the trouble of heating cars detached from the train would be considerable, but not insuperable. Felt assured that railroad men would be ingenious enough to overcome all the difficulties. The charges made by patentees for continuous heaters were too high, and would result in stimulating railroad men to devise systems for themselves. Quoted letter from Mr. J. N. Barr giving his experience with the Martin heater, which stated that trouble was experienced from couplings leaking, but he thought that was owing to defective design. The steam trap had worked admirably. The reducing valves had been interfered with by the precipitation of lime salts from the feed water, and this proved troublesome even when water was taken from dome.

A motion was carried permitting Mr. Sewall and other inventors of car heaters to express their views.

Mr. D. D. Sewall, of the Sewall Car Heater Co., thus described the system he represents: Steam can be used for the continuous heating of a train from any boiler that is available. We use the locomotive boiler, however, because we find it the best and the cheapest for this purpose. Passing the steam from the dome back toward the train, instead of using a reducing valve we use a plain globe valve, or a valve with a beveled joint, behind which we put a steam gauge that will give us the exact pressure at which the steam is going back to the train. Reducing valves are well enough, but we who know them and their construction know that there are a great many delicate parts. A little bit of scale, the working through them of water, sediments, or from a great many other causes, their functions cease, and instead of reducing to a degree of pressure that we have arranged for, we do not know what pressure we are obtaining in our cars. It may be the pressure of the locomotive boiler, and it may be a less pressure than we desire. We consider the steam gauge preferable. Our first effort has been that of safety; consequently we have aimed at simplicity, to have it come within the knowledge of whoever might be the operator. We have a coupler of our own device, which we guarantee is tight under all circumstances. You can not make it leak. It is very simple in construction; does not rotate on the gaskets. The joint faces meet and are held in position by locking devices that are very simple. Once engaged, it remains so until disengaged either by the operator or by the separating of the cars, in which case it disengages itself. We enter the car with our pipes at about the center, giving them pitch for drainage. The radiating pipes run along the side of the sills of car. We have no spurs out under the seats. We consider it objectionable to the system. In case of derailment or accident of a serious nature, the car seats spurs and all those things naturally go to the forward end of the car. We have also in the center of the car a controlling valve of very simple construction. A portion of the steam can be admitted through this valve by the adjustment of a key in the socket in the floor of the car. More or less steam can be admitted as is desired, and the arrangement is such that we can heat one of the radiating pipes along the wall, two, or the whole, or cut it entirely out. We can heat the first car, or the second, or the last, any one, or all. We can concentrate the heat upon any car that is desired. Whatever is done on one car in no way interferes with any other. There is no danger from scalding accidents, as the steam is used at a very low pressure. It is never used at a higher pressure than five pounds, even in the coldest weather. The coupling by which we pass the steam from the engine to the cars and from car to car is very substantial. There is no part of it that is subjected to wear. We have subjected it to a pressure of some 220 or more pounds, hydraulic pressure, and it is utterly impossible to make it leak. It is absolutely and always tight. There is nothing about it to be renewed except the hose and that can be used for a number of years.

Secretary Sinclair read letters from Mr. W. Augustus, of the Missouri, Iowa & Nebraska; Mr. Jacob Johann, Texas Pacific; Mr. J. M. Lowry, Milwaukee & St. Paul, and Mr. John Hickey, Milwaukee & West Shore.

Mr. Hickey wrote that car heating had been discussed by railway men for the last twenty years, and it was owing to the great difficulties in the way of a change that no radical change had been made; enumerated many of the patent heaters devised to provide safe means of heating and believed the fact that none of them had come into general use proved that they did not meet the requirements; objected to making changes on existing system under the pressure of exciting influences, and thought unless moderation tempered by wisdom is exercised in railroad mechanical channels, false conclusions would be reached. Insisted that it was not the stove that was responsible for late deplorable accidents, but the method of operating trains; wanted more care exercised in preventing accidents; did not think heating cars by the continuous method was practicable in this Northern climate; considered the independent system of heating by hot water was founded on good principles, but all forms of such heaters will bear much improvement; thought they would do for parlor and sleeping cars, but could not recommend them for general coach heating. It was urged against the common stove that it is a fragile concern, liable to break like an egg shell from the slightest accident, and that it is usually placed at the end of the car, where, in case of accident, it could not escape destruction, thereby scattering the fire and endangering the car and its occupants. It was true that in many instances the stoves are of fragile construction and located badly, but was that any reason why that principle of heating should be entirely discarded? If a machine for performing certain duties is improperly constructed, and if, further, it is located at a point where, under certain circumstances, it would endanger life and property, is it not clearly the construction and location that are at fault, and not the principle? Let us therefore apply to this principle the remedy of proper construction and suitable location, and we have mastered the simplest, safest and surest manner of heating railway cars. Stoves properly built of wrought-iron, located at a point near the center of the car, and properly inclosed in a safe-like wrought-iron box, having means of admitting cold air at bottom or top, and hot air pipes leading therefrom on the inside, is not only a sure, plain and comfortable manner of heating, but for safety will be found to compare favorably with any appliance for this purpose yet discovered. It is, however, folly for the mechanical heads of railways to attempt the construction and application of any heating apparatus, and guaranteeing its entire freedom from evil results, if the causes that led to the recent severe accidents are permitted to remain.

Mr. Lowry wrote that he had watched the operation of the locomotive pulling the train equipped with the Martin heater, and found that it spared the steam very well. For that sized train he believed heating by steam from the locomotive to be perfectly practicable. But with a heavier trains, and a Minnesota blizzard blowing and the thermometer 38 to 40 degrees below zero, he did not think the most enthusiastic believers in steam heating would be justified in dispensing with the use of stoves.

Mr. Johann wrote: While most members seem to be of the opinion that the stove is the great culprit, and does all the mischief by setting fire to derailed or wrecked cars, I am of the opinion that the stoves should not be universally or entirely condemned. He believed the weak points of the stove to be that they were not made strong enough, and are not secured properly. After the Angola accident, he devoted particular attention to making the stoves safe. They were using at that time the Spear hard coal burning coach stove. He took off all the outside appliances for opening the doors and substituted an automatic locking arrangement placed inside the stove. This was done to keep passengers and others from meddling with the fires. At the same time he placed a deflecting plate inside the stove right under the pipe opening, which was suspended on the same principle as the cone in a locomotive smoke-stack. The stovepipe was made of extra heavy iron and all the joints riveted except the stove connection. To secure this there was a sleeve riveted on to the top part of the stove, 12 inches high, and the stovepipe set down over it, making a 12-inch slip-joint. The stove was properly secured with strong strap bolts. The safety of the arrangement was fully demonstrated subsequently by an accident where a passenger train went down a ten foot bank. Several of the cars were turned upside down, but the stoves remained intact and no ashes even were thrown out. The object of the deflecting plate was intended for just such accidents, and it acted well in preventing live coals from escaping. This experience led him to think that the stove can be made reasonably safe, but it will not do to burn wood or bituminous coal. Thought the Baker heater, if made somewhat stronger, would be reasonably safe, and until something better is devised that would be his preference. Believed the lighting of railroad cars with illuminating oils more dangerous than stoves, and favored the use of gas or electricity for the purpose.

Mr. S. H. Harrington, Pittsburgh, Cincinnati & St. Louis, read a paper answering the question, "Can our present system of heating passenger cars be made safe?" Described various methods they had attempted to apply to the heating of cars and the difficulties encountered. They have a hot air system in use for heating their shops, and they considered its application to car heating.

In order to maintain a uniform temperature of 70 degrees on a train of 15 cars, when the outside temperature is 10 degeees below zero, it would be necessary to use an apparatus of the size used in our Columbus paint-shop, with a 6-foot fan and 1,034 feet of steam pipe. The cubic contents of this shop is about 250,000 cubic feet. A car 50 feet long, 10 feet wide and 9 feet high contains approximately 5,000 cubic feet, and a train of 15 cars will contain about 75,000 cubic feet, or about 30 per cent. of the contents of the paint-shop. Making due allowance for the losses resulting from opening doors and windows, leakage occasionally by bad joints and fits, and escape through ventilators, we will not fall far short of requiring the same size apparatus as in our paint-shop, and as this would be too large and heavy, we abandoned it.

As another obstacle in the way of this system to the adoption of steam as a heating agent, I might mention the transfers which a passenger train undergoes on a trip like the one from St. Louis to Jersey City, besides the cutting out of baggage and other cars at as many or more points. Now I do not wish to be understood as being adverse to the application of steam for heating cars, but ask you simply to view the matter in an unprejudiced light, and as it presents itself. Were we disposed to be hypercritical and unreasonable in dealing with the views of well-known men on this subject, we might make it as brief as that famous chapter devoted to the snakes of Ireland, and which simply is, "There are no snakes in Ireland." But such is not my intention. After seeing that no matter which system we might adopt, we could not at once entirely dispense with the stove, we turned our attention to solve the problem of making a fire-safe stove.

Mr. Harrington then exhibited a full sized drawing of an apparatus he had invented for automatically extinguishing fire in stoves, in connection with the operation of a derailment brake, in case of accident. [Engravings representing the apparatus and brake will be found on page 49] The device had been applied to a car belonging to the company, and subjected to severe tests in service with the most satisfactory results. The principle of the device is briefly as follows:

When a car leaves the track, the derailment attachment shown in the illustration not only sets the brake, but admits air from a storage reservoir into a siphon filled with sulphuric acid. The acid is forced into a soda tank, generating carbodio gas, which extinguishes the fire in the stove.

The apparatus consists of four main parts: The derailment attachment, the storage reservoir for air, the extinguisher and the case containing the acid. The first has a strong spiral spring and a trigger actuated by a small spiral spring, the spindle seating on a rubber washer. The storage reservoir is underneath the car, and has two differential valves seated by a spiral spring. The extinguisher contains a hose arranged so as to always lie on the bottom of the tank shown inside the car. The acid is in a glass vessel with lead siphon, and is also inside the car. Separate pipes connect the derailment attachment with the storage reservoir. Other pipes connect it with the acid and the extinguisher, and the latter is further connected with the stove as shown in the illustrations. The case containing the acid is placed in a projection from a panel in the side of the car. We were forced to apply it in this way, owing to the peculiar build of the car. In cars built hereafter, this lead siphon containing the sulphuric acid will be hidden by being placed between the inner panel and outside covering of a car. Sulphuric acid is forced through the opening at the top of the siphon into the soda tank, and from there does its work, extinguishing the fire. In order to empty the extinguisher tank inside the car of liquid the hose is weighted at its free extremity with a lead collar, so that in whatever position the car may be the gravity of this collar will always lie at

the bottom of the tank, thus allowing the liquid and not the gases to escape into the stove. A dome can be substituted for the siphon confining the chemical action to the chemical tank, the air being forced on top of the acid causes it to pass through rubber tubing into the soda.

In case one car becomes derailed the brakes would be applied to the whole train, but the fire would be extinguished only in one car. The storage reservoir acts independently of the main pipe pressure and therefore the fire will be extinguished, even though the engineer had applied his brake before the collision or derailment. We have designed a peculiarly shaped valve for cars heated by steam or suspended heaters. In case of derailment the steam is turned into a vessel filled with sawdust. If the body left the truck still on the rails the hose would part, applying the brake and actuating the fire-extinguishing apparatus.

In case the car is inverted it is impossible for the hot coals to fall out through the door unless it is left open. A perforated cone is placed in the opening for the stove-pipe, and will fill the space as soon as the car is inverted; the carbonaceous gases will force the liquid into the stove regardless of the position of the car body if the air is liberated from the storage reservoir or main pipe. In case of incipient fires, the extinguisher could be used like any other device now in use. The apparatus would probably cost about $75 per car.

An efficient derailment brake must be so constructed that if the valve be raised off of its seat even only ¼ in., it will not reseat itself, and if the wheels were to leave the track sideways, the cross-arm must be long enough to strike the head of the rail. If the valve stem or cross piece is raised, it should be free to rotate, so that it will not be rendered worthless after using it once. The derailment brake can be used to good advantage in railroad crossings by means of a stop in connection with semaphore signal. It could, by applying it to the engine truck, be made to stop a train in case of ignoring a signal or failure to make a stop. When freight engines are equipped with driver brakes and using straight air, the raising of the valve stem can be made to open an air-cock, thus admitting air to the brake cylinder from air reservoir, and where no brakes are attached to engine, a frangible disk can be used, making it a penalty where such a disk is broken.

Mr. Carscadden, representing the Herr Safety Heater, read a description of it, and offered to make a test of it without charge if any one would furnish the freight cars for the purpose.

Mr. L. Cline used a tin model to give a description of his heater, which uses a peculiar fuel that burns like a mass of molten lead. It is used extensively in heating street cars for which the system is particularly well adapted, but it has not yet been applied to railroad cars. The inventor made a strong plea for patronage by railroad companies.

Mr. Barr expressed himself as being well satisfied with the experience they had had with the train equipped with the Martin heater. They did not know how the system would work in very severe weather with the thermometer 30 degrees below zero. To them this is the main question of car heating.

Mr. George Gibbs, Chicago, Milwaukee & St. Paul, the engineer of tests who had charge of the train equipped with the Martin system, gave interesting data relating to their experience with the train. He said our idea was to settle three points this winter, viz.: Could we keep the cars as warm as with ordinary heaters? Could the locomotives bear the loss of steam? Would the pipes freeze up? We were unable to settle these questions for our own road, going through a very cold country, but perhaps we have settled them for Eastern roads. We had seven tests with the thermometer from 30° to 50° above. In these, the average steam used was 70 pounds per car per hour. With the temperature at 15° above, the steam used was 100 pounds per car per hour. At 10° above, 115 pounds of steam was used per car per hour. We made a heating-up test out in Dakota at 10° below zero, and found that with a train of four cars it took us about three hours to heat up to 70°, and we consumed 280 pounds of water per car in doing it. We had about 18 pounds pressure at the engine and about a pound and a half in each car. At 10° above, we found that we had not more than half a pound when we had eight pounds at the engine. I believe from these experiments that there is very little advantage to be gained by using a higher pressure in the car than five pounds. The latent heat in the steam increases so slowly with increase of pressure, that no heating advantage accrues from high pressure. The reducing valve does not work well with our Western waters, which contain a great amount of sediment. The trap works very satisfactorily indeed. Taking one pound of our coal as capable of evaporating six and a half pounds of water, it would take about seventeen and a half pounds of coal to heat each car per hour. Estimated that it took eight and a half per cent. of the capacity of a locomotive to heat the train. Had no trouble from freezing, but thought there would be difficulty in keeping traps and couplings free from ice. The result of the heating has been very satisfactory. There is no question but you can heat a car more uniformly, agreeably and economically by a system of radiating pipes than by any other form of heater.

The president inquired of Mr. Barr if his experiments had gone far enough to know what effect steam heating will have on the finish of cars?

Mr. Barr replied that they had not.

Mr. Johnson moved that it is the sense of the members of the Western Railway Club that it would be advisable for railway companies to investigate thoroughly and experiment with continuous steam heating of passenger trains; and that a committee of three be appointed by the President to endeavor, through the managers or general superintendents of some of the prominent railroads running into Chicago, to equip trains on different roads with different devices.

He explained that in making this motion his object was to get the united action of the railroads running out of Chicago. Roads radiating from this point had to provide heat for very severe winters, and they were able to settle the problem of the best methods of car heating.

Mr. Barr did not wish to see the influence of the club exerted in favor of continuous heating, for they had got fairly good results from the independent systems as represented by the Westinghouse and other safe devices.

Mr. Forsyth was against stoves in all forms and hoped the motion would prevail.

Mr. W. B. Snow, Illinois Central, was satisfied with the means of heating they now had in use and did not think a change was desirable.

Mr. Harrington said they had used the Winslow heater satisfactorily. They had an accident where the train went down a bank, and the water carried in connection with that stove extinguished the fire. Railroad companies could not afford to throw out devices of that kind till something very decidedly better was perfected.

Mr. Johnson did not see how the action proposed by the motion was to interfere with existing methods of car heating or prejudice those that had merit. If railroad men did not soon display a tendency to introduce safe methods of car heating, the Granger legislators would take the matter out of their hands.

President Scott favored the motion, as he wanted to see the various continuous methods of heating fairly tried. Thought it was the duty of the club to indicate what systems were worthy of being experimented with. Was favorably impressed with the future of the continuous system.

Mr. Rhodes thought if the motion were carried it would merely be an expression of opinion, as was done in the Master Car-Builders' Association some years ago in regard to car couplers. Believed the expression of opinion would not interfere with other experiments, but thought it would be influential in securing the co-operation of different roads to decide on the merits of steam heating for cars.

The motion was eventually carried, and Messrs. Johnson, Forsyth and Barr were named as the Committee. Mr. Johnson said that owing to his absence from the city he could not serve, and proposed President Scott for his place, which was agreed to.

INTERCHANGE RULES.

The rules of interchange were then taken up by Mr. Meade, beginning with Rule 21. On motion of Mr. Meade the following sentence was recommended to be added to Rule 21: "If new standard parts mentioned in Rule 15 be more expensive than original construction, allowance shall be made for the same as may be agreed upon."

Rules 22 to 29 were passed without alteration.

Mr. Meade moved that in Rule 30 the words "or in process of purchase" be stricken out. Seconded and carried.

No other changes were made and the discussion was closed.

Master Car-Builders' Club.

The regular monthly meeting was held at the Rooms, 113 Liberty street, N. Y., on Thursday evening, March 17, the President, Mr. C. E. Garey, in the chair.

The following gentlemen were elected as the Committee on Rooms for the ensuing year: Messrs. R. C. Blackall, Willis Davis, John W. Cloud, J. N. Mileham, J. W. Baker and C. A. Smith.

On motion of Mr. Davis, the subject of changing the name of the club was laid over until October next.

On motion of Mr. Blackall, Mr. C. E. Garey was elected President of the Club for the ensuing year. After returning thanks for the honor conferred, Mr. Garey announced the subjects for discussion to be the

HEATING, LIGHTING AND VENTILATING OF PASSENGER CARS.

Mr. Woodworth, of Portland, Me., in compliance with a request from the chair, explained the construction and operation of the Sewall car heater, with which our readers are already familiar.

Mr. J. A. Faust, of Salt Lake City, exhibited a model of a car heater, representing a stove provided with a water reservoir for extinguishing the fire in case the stove should be overturned.

Mr. M. S. Stanley described the Condon Car Heater, which is constructed so as to close immediately whenever the stove deviates from an upright position. A reservoir of water is also provided for extinguishing the fire.

Mr. J. N. Lauder, of the Old Colony road, congratulated the club on the large attendance, but wanted to see more railroad men present. The railroads in New York ought to make the club the equal of any in the country. Mr. Lauder then discussed car heating at some length, his views being substantially the same as set forth in the proceedings of the Boston club in our last issue.

The remainder of the evening was occupied in the discussion of various heating devices, some of which were represented by models. As a full report of the descriptive details would exceed our available space, and as much of what was said has been said before, we close the report with the remarks of Mr. Chas. M. Smith, of the Robbins Cylindrical Steel Car Co., of Boston, who are building.

A STEEL PASSENGER CAR.

This car, said Mr. Smith, is composed entirely of steel plates, and is made cylindrical in form. The heating and ventilation are combined. The furnaces are under the car. The ventilation is taken under the hood passing along the top down hollow ribs into the bottom of the car. We have a 14-inch air space where we pass the air from a pipe and take it up through registers and out through the top of the car. The car weighs 22 tons against 35 tons, the weight of a Pullman car. It takes 190 tons to break the cylinder through the center. We have a compressible platform that takes 120 tons to start it. Our car is upholstered six inches thick all around inside, so that when you roll down hill you strike something soft every time.

Educate Enginemen.

At a recent union meeting of the Brotherhood of Locomotive Firemen, Mr. William E. Lockwood, of Philadelphia, who displays a warm interest in all things pertaining to the locomotive and its operators, made a long speech, in which he said:

"The nearest work to that of the Almighty is the locomotive. The locomotive engineer of the next decade will be an improvement on the present; he reads more and will know more about this wonderful piece of mechanism. This order set an example for any man or set of men to follow. You, my friends, have many opportunities of holding up their hands. I hope to see the day when the lodges of the firemen will be those of education and when each man will be able to step to the black-board and demonstrate his proposition."

All sincere friends of railroad engineers and firemen will cordially endorse the views of Mr. Lockwood in his desire to have the coming generation of enginemen better educated than the men now on deck. The brotherhoods are exercising a beneficent influence over the members in putting restraints on immorality, and in requiring provision to be made against death or disability, but so far as education and skill in the calling are concerned, the organizations do next to nothing. Devising means to obtain an increase of pay always received the warmest support, but if any man of radical views suggests that there is a duty devolving on the men to earn their advancing pay by an improved quality of work, he is apt to be regarded as a dangerous character. The majority of locomotive engineers and firemen are disposed to regard as an insult any imputation that they are not perfect in everything relating to their business, and the more incompetent a man is the more savagely he resents any question of his knowledge and skill. The power and influence of the brotherhoods appear in many cases to render members less patient to criticism of their personal and professional shortcomings. There is a disposition to point with complacency to their record of membership in the brotherhood, and offer that as a good and sufficient answer to charges of incompetency. Those best informed are aware that the test is far from being an infallible shibboleth. The tendency of the present day is to exact the best possible service from the men operating machinery. To get the best service from engineers and firemen, intelligence and educated training are necessary. If the men as a body are not improving in this respect they are falling behind, for all other departments are advancing. If the brotherhoods are going to retain the power and influence they now possess they have to do more labor in the future on the educational question than they have done in the past.

"Engine" and "Locomotive."

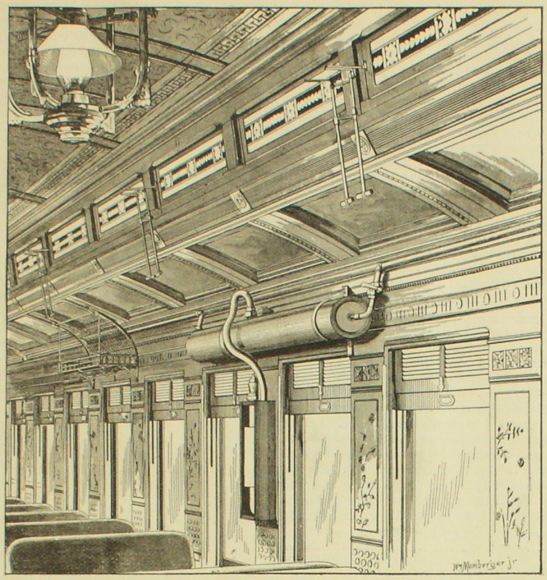
The Latin word *ingenium*, which signifies heart, mind, abilities or genius, was originally applied to any mechanical device or contrivance of an ingenious or complicated character. In the course of time the word became Anglicized into engine, and those who made or operated mechanical appliances were called engineers. It is not so easy to understand how the class now called civil engineers came to appropriate the name. Numerous machines have got their names from a corruption or abbreviation of the word engine, as "gin," "jenny," etc., but of late years the name has been applied almost exclusively to prime movers. "Locomotive," which is now used to a great extent in place of the words "locomotive engine," was first applied in the sense now popularly used, by George Stephenson, who named one of his earliest engines "locomotion." The word was convenient and expressive, and soon came into popular use. Some slight deviations from the word were common in early days. The Norris Locomotive Works, of Philadelphia, when first established, announced that they intended building "locomotors."

Improving the Reverse Lever.

Devising improved means of graduating the movement of the reverse lever of locomotives so that the cut-off of steam may be more closely regulated than is possible with the common quadrant and latch alone, appears to be occupying a great deal of inventor's attention. Among the improvements in this line made public, several are of decided merit, and several display ingenuity of a high order. The Chicago, Burlington & Quincy Railroad Co. are experimenting with a finely toothed quadrant which admits of shortening or lengthening the cut-off by single inches. The Northern Pacific Railroad Co. have an improved quadrant and lever where a worm and rack provides for the movement of the lever any distance. The Central Iowa road has an attachment to the ordinary reverse lever and quadrant which admits of the advancing or drawing back of the reach-rod 1¼ inch without moving the lever. Several roads are using the May latch which enables the engineer to advance or draw back the lever half a notch. The steam and oil reverse gear is gradually finding favor and application to new locomotives. In Canada, many locomotives are equipped with the screw reverse, which admits of the link being held in any position. There is no doubt that this movement to improve on the common reverse lever and quadrant, is going in the right direction. Much saving of steam may be effected by the use of appliances that will enable the engineer to operate his engine conveniently, without having to throttle the steam.

Brake Experiments.

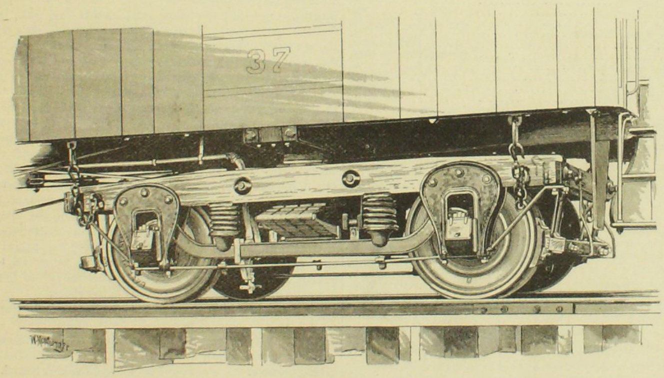
The Chicago, Burlington & Quincy Railroad's mechanical department have been making some experiments with passenger trains to find out the time and distance required to make emergency stops, so that the data obtained may be used for comparison in reporting on the freight car brake tests that will be held in May. They found that the Pullman sleeping cars had their brakes arranged without leverage, evidently for the purpose of saving wheels. The stoppages were made under all possible conditions, and some interesting facts were obtained. When the engine was reversed and the throttle kept closed, it was found that sliding of the drivers ensued early in the stop, and the act of reversing did not make a material difference in the time and distance required for stopping,



FIRE EXTINGUISHER ACTUATED BY DERAILMENT BRAKE.

Pittsburgh, Cincinnati & St. Louis Railway.

For Description see Proceedings of Western Railway Club, page 47.



DERAILMENT BRAKE, ACTUATING FIRE EXTINGUISHER.

Pittsburgh, Cleveland & St. Louis Railway.

For Description see Proceedings of Western Railway Club, page 47.

in comparison to the stops made without the engine being reversed. But when the engine was reversed and the throttle opened, the drivers did not slide at all, and the time and distance required for stopping were materially reduced. They are continuing the tests, and intend finding out what causes the difference between a closed and open throttle. If on putting an indicator or pressure gauge on the steam chest, they find that intense pressure is developed with a shut throttle, it is probable that a release valve may be introduced that will act as a safety valve to permit the compressed air to escape. They changed the leverage of the Pullman cars and made these vehicles do a fair share of the braking, which they had not previously been doing,

Manner of Boiler Inspections.

The following items, taken from "The Rules for Inspection of Steam Boilers," issued by the Union Pacific Railway Co., indicate the scope of the system of inspection lately introduced :

MANNER OF GENERAL INSPECTION.

After boiler has been stripped, thoroughly cleaned and flues taken out, it must be subjected to a rigid external and internal inspection, special attention being given to the following points: All internal seams and joints to be carefully examined, and fitting, grooving or corrosion of any kind noted. All stays and braces are to be examined to see that they are sound and of proper length. All stay-bolts, crown-bolts and rivets, about the soundness of which there is any doubt, are to be tested by light blows of a hammer. Inspector then judges by sound which of them, if any, are broken. The fire-box is to be given close attention, and condition of crown and side sheets, together with any pitting, wasting away or corrosion noted. Corrosion is especially likely to attack iron stay-bolts where copper side sheets are used. Before lagging is put on, all stayed flat surfaces are to be proved with straight-edge, and careful record of result kept.

Boiler must be subjected to a hot water pressure which exceeds the maximum working pressure per square inch in the ratio of $1\frac{1}{4}$ to 1 pound.

While pressure is on, all exposed surfaces of the boiler must be examined and tested with light blows of a hammer; all flat stayed surfaces are again to be proved with straight-edge, and any change of form or defects of workmanship carefully noted.

All material defects must be remedied before boiler is again put in service. In case of doubts as to necessity of repairs, superintendent of machinery must be notified and he will give instruction for that and similar cases.

All new boilers consrtucted at the company's shops must be subjected to a general inspection test. The hot water test to be applied as follows : At localities where hot water injector is at present used for washing out, boiler must be filled with hot water by injector, and test pump used to give requisite pressure for tests. Where it is not practicable to fill boiler with hot water, boiler must be filled with water and fired up; then when temperature is sufficiently high for test purposes, fire must be drawn and test pump used to give requisite pressure for tests. For test purposes, water should be at boiling point, or if that is impracticable never lower than 160°.

Master mechanics will drill holes $\frac{1}{8}$ inch diameter by 1 inch deep from the outside in all stay-bolts. After stay-bolts are drilled any stay-bolt or bolts found leaking must be at once removed and replaced by new ones. In no case whatever are plugs to be driven in drilled stay-bolts to stop leaks or for any other purpose. In boilers with steel or iron fire-boxes and steel or iron shell, few stay-bolts break except on inside of outside sheets ; consequently it is not necessary to drill stay-bolts from inside of fire-box. Inspectors and foremen of shops where stay-bolts are drilled are instructed to notice and report any sign of corrosion or wasting of stay-bolts, particularly on inside of fire-box sheet. Inspectors must also see that holes drilled in any stay bolts are left open ; any thing discovered to the contrary must be noted in red ink on their reports.

A Hidden Brake Danger.

The most effectual safety appliance yet introduced into railroad train service is a thoroughly efficient automatic brake. With a good reliable brake, many other elaborate safeguards against accidents may be dispensed with on railroads where the business is light and the trains run with considerable intervals of time or space between them. But no road, however few its trains may be, can be operated with ordinary safety without the presence of an automatic brake in good working order, at least upon passenger trains. Few railroad managers or responsible officers are to-day willing to question the correctness of our position on this subject, yet many passenger trains very deficient in brake power are run on first-class roads. It appears that the Pullman Sleeping Car Co. have such a tender regard for the welfare of the wheels under their cars that they are in the habit of sending out their sleeping cars so deficient in brake leverage that the brake-shoes are applied to the wheels with merely the force that the air pressure in the cylinders transmits. We have often heard engineers in charge of trains having several sleepers complain about the difficulty in getting brakes to hold, but it is only lately that railroad men have become alive to the fact that brakes on many sleeping cars do not do their fair share in helping to stop the train, for the simple reason that they are not designed to take their fair share. This is a very serious element of danger, and one railroad men cannot afford to ignore. Cars of this description ought to be closely examined by those responsible for the safe operating of the roads they pass over, and a change of the brake leverage insisted on if it is necessary, so that the cars will do braking in proportion to their weight. Moreover, something ought to be done to apply brake shoes to the middle wheels of six-wheel trucks. We have a strong suspicion that the general absence of brake-shoes from the middle wheels of six-wheel trucks is not so much due to the mechanical difficulties in the way of their application, as to the fact that the proprietors of cars having the most six-wheel trucks discourage all efforts that are made to apply brake-shoes to the middle wheels.

Repairing and Wiping by Contract.

For some time back, Mr. James Meehan has been introducing the contract system of doing repair work into the shops of the Cincinnati, New Orleans & Texas Pacific Railroad, and he speaks very highly of the benefits accruing to the company and to the workmen by the change. The greatest direct advantage derived from the system is the greater quantity of work turned out with existing tools. The capacity of some of the tools has been doubled by making the men financially interested in getting the work out as rapidly as possible. As the company follows the policy of treating the workmen fairly, and giving them the advantage that should proceed from increased industry, the pay-roll saving to the company is not so great as might be expected, but the expense for repairs is reduced about 20 per cent. Mr. Meehan intends extending the system to various operations of the car department and to the wiping of locomotives. The practice of having locomotives wiped by contract has long been in vogue in Britain and has worked well for all concerned. To wipe a locomotive is obviously an operation that should be paid for according to work done, and it would doubtless be paid for in that way in American roundhouses were it not that the wipers are called upon to do a great deal of other work that would complicate the system of payment.

Proportion of Locomotive Cylinders.

The following circular has been issued by the American Railway Master Mechanics' Association, dated Dunkirk, Feb. 17, 1887 :

1. What rule do you recommend being used in calculating the proper size of cylinders of passenger locomotives, when boiler steam pressure, diameter of driving wheels and weight on same, are given quantities ?

2. State what, if any, deviation from this rule should be made in the case of freight and switching engines.

3. State your reasons for adopting such rules, and, if possible, demonstrate the correctness of the same by results obtained in every-day practice.

4. In making the calculations referred to, do you assume the diameter of driving wheels to be diameter outside the tires *when new*, or when *half worn* ? What percentage of the boiler pressure do you assume to be the average cylinder pressure ?

5. Does your experience indicate that engines in which the ratio of weight on drivers to tractive power is much below the average, give better or worse results in work done, and in the economical performance of same, than engines of same tractive power, and in which the ratio between weight on drivers and tractive power is above the average ? Is life of tires longer in one case than the other ?

6. If you can present any facts bearing on this subject, and which may be of service to the Association, you are respectfully requested to communicate the same.

Replies to be addressed to Charles Blackwell, care U. P. R., Omaha, Neb.

F. L. WANKLYN, G. T. R.
T. E. BARNETT, C. P. R. } Committee.
CHARLES BLACKWELL, U. P. R.

Communications.

Extension Smoke-Boxes.

Editors National Car and Locomotive Builder:

I was very much pleased with the article in your last issue by Mr. J. Snowden Bell, on the Extension Smoke-Box. I would suggest, however, that Mr. Bell might have gone a little further without fear of contradiction, and stated that when the extension smoke-box became a prominent feature in the locomotive a few years ago, it was a novelty to many master mechanics, and several of them adopted it on the say-so of others, and oftentimes the results were attributed to the abnormal appearance of the front end, instead of the other appliances, which, "though lost to sight," gave all there was of real value in economy and improvement. Instead of the elongated front end being a factor of economy, it very materially reduced the good effects of the brick arch and unrestricted exhaust.

There seems to be a healthy reaction taking place in the mechanical departments of several roads as against the recent boom in front ends. A disposition is shown by the most radical to go a little the other way, and reduce the size of smoke-box below the usual measurements heretofor in use with the diamond stack. It seems to be only a question of time when we will see the proportion of two cubic feet in smoke-box equal one square foot of grate as the rule for size of smoke-box. With a well adjusted brick arch, straight open stack, and a high double, combined with a single large nozzle, we may expect results which will far exceed the doctered data often credited to the additional length of smoke-box.

A very amusing incident came to my knowledge a few days ago regarding the "effect" of the extended smoke-box on a road not a thousand miles from New York. One of the directors of the road, in company with the superintendent of machinery, was strolling around the shop buildings, and, coming unexpectedly upon a large hill of small coal, the director asked why the coal had been dumped on the ground instead of being put on the coal platform? And on being informed that the seeming coal hill was the sparks caught by the extension front engines, he shook his head and remarked: "Well, are you going to use that coal over again, or is there no way you can keep the coal in the fire-box until it is burned?" The question asked by the director is one which ought to induce railroad engineers to put on their thinking-caps. I have had one on my head for a short time, and beg to submit the result to you and your readers.

In an effort to "keep the coal in the fire-box until it is burned," I would suggest the use of a short conical perforated strainer, one to be inserted in each flue in the fire-box, each strainer to be pushed in the flue until clear of the face of flue sheet a good half inch. The spring action of the strainer body will keep it to its position in the flue, and the temperature of the flue will protect the strainer from becoming overheated. The strainer can be made in half sections out of thin sheet steel, and the perforations could be elongated or square, and punched out before the two sections are riveted together. Two rivets near the point would hold them together, leaving the large portion to spring together while putting the strainer in the flue.

I know that this plan will meet with many objections, owing to the reduction in the flue opening by the presence the strainers, but it is simply a matter to be settled by experiment, whether the open front end, open straight stack and improved vacuum, will not offset any little reduction in the flue opening from the fire-box. I have used a few strainers in the fire-box of an engine having the diamond stack, and the strainers were not affected by the action of the sparks rising from the fire, and the flues were kept clean and free from cinders.

In conjunction with the strainers in the fire-box, should be added, in order to make the plan a success, a well arranged brick arch, so placed that the bottom edge of brick should be clear of the flue sheet not less than two inches, giving the sparks which rise over the brick arch and against the strainers an opportunity to fall to the fire through the open space between the brick and flue sheet. In conclusion, and with all due respect for the opinion of others, I would say that the above plan or something similar will have to be adopted sooner or later.

NEW ORLEANS, March 13, 1887. R. G. N.

Car Heating by Steam.

Editors National Car and Locomotive Builder:

The more one thinks about the matter of car heating by steam the more simple it seems, and the wonder is that it has not been done long ago; but though the matter is simple, there is no doubt but the policy of taking steam from the locomotive is an erroneous idea, and if adopted will only be a makeshift till the better plan proves itself, when all roads will of necessity have to build a car and equip it for the special purpose of furnishing heat, light and perhaps food on long trips. Thinking the subject over, there is no reason to retain the stoves in the service, and thereby necessitate the carrying of coal into the cars and storing it in boxes occupying valuable space and making dirt, when it can all be avoided probably at less cost. One objection raised at the last meeting of the Western Railway Club was, the cars would get cold in the event of being set out at junction points (where connections were not close) by waiting for connecting trains. That objection could be swept away by keeping a small boiler that was made portable, either by placing it on an iron push-car, or on two wheels as (for a case in point) the kettle for boiling tar is fixed. One man could handle that. Equip the boiler with steam hose and connections to fit connection on cars. By so doing the cars could be kept warm, the space occupied by stoves and appliances utilized, the dirt avoided, and it is doubtful if the cost would exceed that of furnishing fuel for the stoves as at present in use. An arrangement of this kind could also be used to advantage at terminals for heating the trains before leaving. As an auxiliary in case of accident to a car equipped for heating purposes, there could be a pipe, with connection for cars, attached to the engine, to be applied only in case of emergency. In fact, heating cars by steam can be accomplished quickly, surely and safely if tried with a determination to do so.

FAR WEST MASTER MECHANIC.

Locomotives Compared.

Editors National Car and Locomotive Builder:

I notice in your last issue a description of a new locomotive, called the "J. W. Miller," recently built by the Rhode Island Locomotive Works, which is said to be the most powerful passenger locomotive in America. I must beg leave to question the correctness of this assertion, as engines of this class were designed and built at the Delano, Pa., shops of the Lehigh Valley road in 1882. For the purpose of comparison, I give the dimensions of the "J. W. Miller," built for the New York, Providence & Boston road, and the "Delano," built by the Lehigh Valley road.

Dimensions of the "J. W. Miller."

Cylinders	18 × 24 in.
Fuel	anthracite.
Driving wheel base	7 ft.
Total wheel base of engine	21 "
" " " " " and tender	46 "
Weight of engine	96,000 lbs.
" on drivers	72,000 "
" " truck	24,000 "
" of tender	62,000 "
Boiler	Otis steel, ½ in. plate.
Waist diameter	54 in.
Number of tubes	218
Length " "	124¾ in.
Driving wheel diameter	6 ft.
Tire	Midvale steel.
Axles	Krupp's crucible steel.
Diameter of journals	8 in.
Boiler pressure	180 lbs.
Length of fire-box	126 in.
Width of fire-box	43 "

Dimensions of the "Delano," No. 66.

Cylinder	20 × 24 in.
Driving wheel base	94 "
Total wheel base of engine	22 ft.
" " " " " and tender	47 "
Weight of engine	98,420 lbs.
" on drivers	73,420 "
" " truck	25,000 "
" of tender	54,000 "
Boiler	Otis steel, ½ in. plate.
Waist diameter	54 in.
Number of tubes	220
Length of tubes	140 in.
Driving wheel diameter	68½ "
Tire	Midvale steel.
Axles	Midvale steel.
Diameter of axles	7 in.
Boiler pressure	130 lbs.
Length of fire-box	129 in.
Width of fire-box	43 "

Those who are acquainted with the building of locomotives will see the advantages the Lehigh Valley engine, No. 66, has over the New York, Providence & Boston engine, No. 40, viz., larger cylinder, greater weight on driving wheels and smaller wheel. Our experience with boiler pressure leads us to believe that the most satisfactory results are obtained from boiler pressure at 135 lbs. to the square inch, and that more than that is comparatively useless. The method of firing the "J. W. Miller" is quite a curiosity to those using anthracite fuel. In our experience we have never found it necessary to have more than time enough to oil without any attention to the fire, as from the time of leaving the engine house until coupled to the train and ready to pull is often less than five minutes.

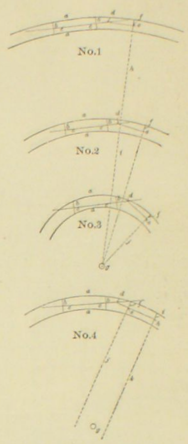
The speed and train for which the "J. W. Miller" was built is not considered extraordinary here, as we have with engine 66 and eight coaches attained the speed of running the distance of nine miles between stations in less than eight minutes, consuming about 7½ lbs. of anthracite coal to the car mile. W. J. MCCARROLL.

DELANO, Pa., March 15, 1887.

The Proper Length of Radius Bar.

Editors National Car and Locomotive Builder:

My attention was called some time since to some mogul locomotives which the master mechanic said had constantly jumped the track until he had shortened up the length of the radius bar of the truck. He did not know why the shortening of the radius bar cured the trouble. As is generally known, mogul engines use but one pair of truck wheels, in order to allow of placing the forward pair of driving wheels close up to the cylinder. The frame of the truck wheels is pivoted to a cross piece under the cylinders by "radius bars," the object of which is to present the truck wheels normal, or to use a commoner expression, "square" to the rails of a curve the engine may be going round, or, in other words, if the center line of th truck axle were extended it should intersect the center of the curve the engine is on. If the radius bar is of the proper length and properly pivoted, this will be the result on all curves. In Fig. 1, *a a* are the rails of a curve, *b b* the center lines of the two forward driving axles, *f* the truck axle, which, as shown by the dotted line *h* extending to the center, is a radial line; *c c* is a center line through the length of the engine. Perpendicular to the axle *f* at its



center *e* the line *e d* is erected, which at its intersection with the center line of the engine at *d* locates the proper point for pivoting the radius bar, and the length *e d* is the correct length of the radius bar. Now, if we place the same engine on a shorter curve, Fig. 2, and with the same lengths, etc., locate the truck axle, radius bar, etc., we find the truck axle *f* is still a radial line; and, on a still shorter curve, Fig. 3, the same result is obtained, proving that, when correctly designed, the "radial truck" is correct for all curves. In Fig. 4, if we make the radius bar too long, as was the trouble with the engines mentioned at the beginning of this article, we find the truck axle is not presented square to the curve, as the line *k* shows, but is presented at an angle which tends to lead the engine off on the outside of the curve. This is due to the length of the radius bar *d h*, Fig. 4, to which the axle *i* is perpendicular. If we shorten the radius bar too much, as *d e*, the axle is held at an angle tending to lead the engine off the rails on the inside of the curve, as the line *j* shows, which is a continuation of the axle *f*, *g* being the centre of the curve the engine is on. Therefore, if a radial truck jump the track on the outside of the curve invariably the radius bar is too long; if on the inside of the curve the bar is too short.

The rapid cutting of the truck wheel flanges indicates a wrong length of radius bar.

Simple as the matter is, there are many engines running with the wrong length of radius bar, and are constantly giving trouble. FRANK C. SMITH.

The Stark Car Brake

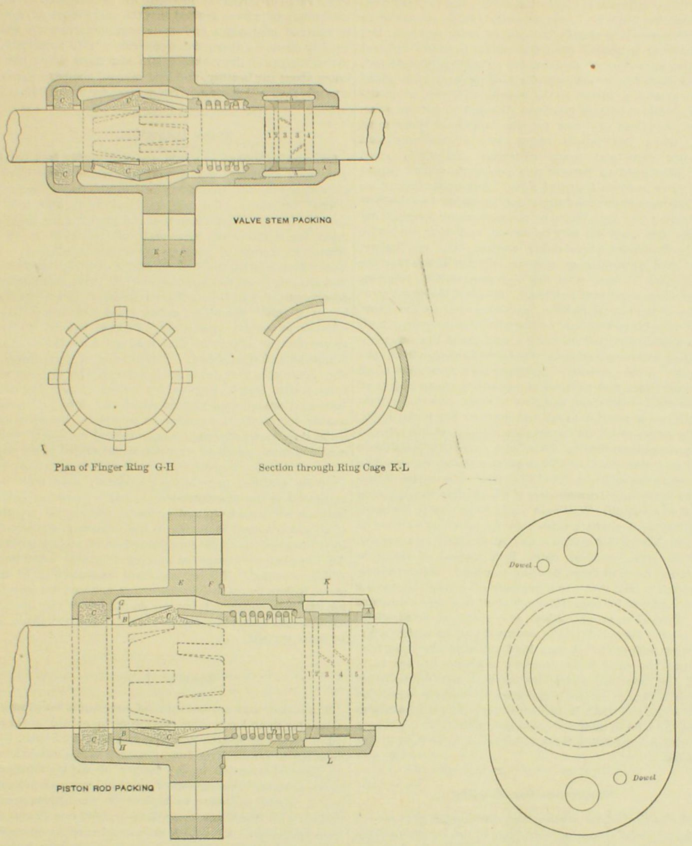
Editors National Car and Locomotive Builder:

Permit me to call attention to an improved brake for freight cars. It is the invention of Mr. J. W. Stark, of Toledo, O., who has had long experience in railway car departments, and for the last four years has been joint car inspector at Toledo. In this capacity he did not fail to observe the enormous amount of damage done to cars in yard switching, and in order to lessen this great expense, he designed and perfected what is known as the "Stark Car Brake." This brake has been in daily use on a large number of cars for nearly two years, and has proved itself to be both effective and durable, saving expense not only in the repairing of cars, but also a great deal of hard work, and it may be many lives.

Being interested in the maintenance of freight equipment, and having been employed in railway track-yards, I can appreciate the importance of such a device and the claim it has upon the attention of railway men. It has already found favor with all practical men who have examined it.

For the information of those who have not seen drawings of it, or the brake itself in actual operation, I would say that it is a hand-brake, of course, and consists mainly of two wrought-iron levers which can be operated from the top of the car or from the ground, one of the levers applying the brake and the other releasing it. Its great advantage is in yard switching. Car inspectors can see every part of it from the ground. It can be used to advantage to each car equipped with it, without regard to the brake attachments of other cars.

TOLEDO, O., March, 1887. FOREMAN REPAIRER.



NEW METHOD OF GLAND PACKING.

THE packing illustrated in the engraving, and which was invented by Mr. W. T. Small, assistant superintendent of motive power, and Mr. H. H. Warner, master mechanic of the Western Division of the Northern Pacific Railroad, has been in use for some time on locomotives running into Tacoma, W. T., is thus described by the inventors in a letter addressed to this office :

"The principle is new, and we cannot find that any have touched this principle before, and have just received a patent. We had thought for a long time that the principle of packing piston rods and valve stems by means of screws and springs pressing wedge-shaped metal rings or flexible packing down on the rods as radically wrong, often causing undue friction by screws being set up too tight and springs too strong, and at all times, whether engine is working heavy, light or without any steam, there being always the same pressure and friction on the rods. It is only that we have not asked a high-pressure duty of an engine as with a hydraulic ram, jack, pump, etc., that we have been able to work them at all. They (hydraulic apparatus) were not a success when packed with screws or springs the same as engines are now, and it was only when we allowed them to pack themselves by means of their own pressure that they were a success; and what we have tried to accomplish in the true principle packing is that the metal rings pack the engine as the small leather gasket packs the powerful hydraulic ram by means of its own pressure, and as in the ram when the pressure was shut off, there would be no friction on the rod. By reference to the cuts it will be seen that the small rings are for that purpose with a steam engine. Two small metal rings, with one thin outside ring covering the two, are put in a cage, which is fastened to the gland and set into the stuffing box. The cage holding rings has openings as in a pump valve case to admit steam on the outside of rings, forcing them down on the rod. As soon as the steam is shut off, rings release themselves, leaving no friction on the rod. The area of exposure of rings can be proportioned to obtain any desired pressure one inch in length, which seems to be about the right proportion (two rings half-inch wide). This seems to be all actually necessary to pack an engine. Sometimes a little steam will pass the rings, enough to annoy some particular engineers. To prevent this from coming out we have two small finger cages with wicking wound around the rod between the cages, and a light spring behind to take up the wear of wicking. The wicking, as in the metal rings, is put in so that the lost motion in cross-head, or packing getting down in cylinder cannot break or tear them up, as in rigid packing. No attention need be paid to engine as to lost motion on account of packing, it will work as long as engine is safe with hardly perceptible wear. No attention need be paid to lubricating or fear of rod or packing cutting, as only one-half the time the engine is working steam is there any pressure. Then the steam will lubricate it, and when steam is shut off there is no friction and no need of lubricating. The little wicking used in finger cages will last for months, all parts of packing except small rings when once made will last the life of engines, and it is thought rods will do the same almost without turning. No check rings are used. It is the opinion of engineers who have used this packing that an engine is from one to two cars more powerful. This should make a small saving in oils and fuel.

W. T. SMALL,
H. H. WARNER.

Locomotive Proportions.

We publish elsewhere the circular of inquiry issued by the committee appointed by the Master Mechanics' Association to investigate the subject of proportion of locomotive cylinders. In a good locomotive the cylinders are designed so that the power transmitted shall harmonize with the size of the driving-wheels and the weight resting on the same. The cylinders are also proportioned to the boiler, so that no difficulty will be experienced in generating the steam used by the cylinders. As to the proportions between the cylinders and the diameter and weight on drivers, there ought to be room for little diversity of opinion; yet an examination of the details of the locomotives on the various roads throughout the country, will show that very great diversity prevails in the proportions of cylinders to the elements of adhesion. This is a question where there is a correct proportion, and any material deviation is a mechanical blunder. A locomotive working on a road that traverses a sandy, arid region, may work satisfactorily with a little less adhesion in proportion to the cylinder capacity, than an engine pulling trains over a moist region where the rails are smeared with clay; but these are extreme conditions, and locomotives ought to be proportioned so that they can do their work on an ordinary dry rail without slipping. On the other hand the ratio of power between the cylinder and wheel should not be so low that the engine is logy in starting or next to useless on a grade that has to be overcome by hard pulling. The engine that has too much cylinder power for the diameter of drivers and weight thereon, tears the machinery to pieces by habitual slipping, and wastes fuel by rending up the fire with the tumultuous fitful draft that accompanies slipping; the engine that is deficient in cylinder capacity must necessarily be a slow and inert machine, that takes long time to pull a train into speed, and is liable to stall on heavy grades, causing inconvenience and delay to the traffic and wear of temper on the men responsible for getting the engine over the road. A locomotive of the latter kind is usually easy on fuel, and is durable as a machine, but she is certain to be unpopular with the men who handle engines, and with the officers responsible for the prompt and regular movement of trains. A well proportioned locomotive strikes the mean between the engine that excessive cylinder power makes slippery, and the one which is logy from deficiency of power. It ought to be easy for master mechanics to agree in the proportions which strike the happy medium. If all the master mechanics who are members of the Association would answer the circular of inquiry, a mass of data would be collected that would give valuable assistance to the committee in formulating proper proportions of cylinders in relation to the weight on and size of driving wheels.

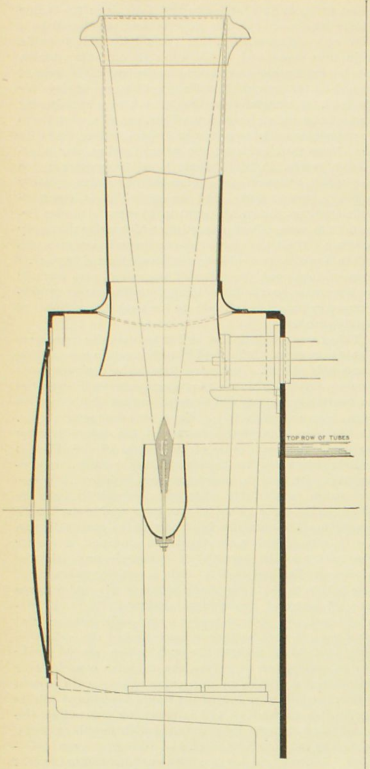
The proper proportion of boiler to cylinder capacity is likely to be greatly influenced by local conditions respecting the supply of fuel. Too many locomotive designers have made grievous mistakes by proportioning their cylinders to heating surface on the assumption that all locomotives must burn coal of nearly uniform heat-producing power. It has been abundantly shown that the widest diversity exists in the heat value of coal found in the different carboniferous regions throughout the country, yet locomotives with only the heating surface required to generate steam comfortably with best Pennsylvaia coal, are daily sent to roads where inferior Iowa coal or even semi lignite must be burned. The best that the committee can do in this regard is to direct the attention of master mechanics to the necessity of having the proportions of their cylinders and boilers made to suit the character of the coal to be used. In many instances it would increase the efficiency of locomotives designed to burn first-class coal and sent to roads where only inferior coal was used, if the master mechanic bushed the cylinders, but that is a makeshift resort which should never be necessary, for to reduce the cylinder capacity of a locomotive is always an unpopular change with certain officers of railroads. Indeed the traffic department officers have often exerted an evil influence on locomotive efficiency and economy by interfering with details of design that they did not understand, and calling for large cylinders. Locomotives are generally rated for hauling freight according to their cylinder capacity, and nearly all traffic men are familiar with the fact that an engine with cylinders 19 inches diameter usually pulls more cars than an engine whose cylinders are smaller. This is an instance of a little knowledge being a dangerous thing, for being interested principally in getting cars over the road, these men often advise that the cylinders of new locomotives be made larger than the proportions of the other parts require. Master mechanics are often persuaded against their better judgment to follow the advice of other officers and order over-cylindered engines that never give satisfaction. It is to be hoped that the ventilation which this subject is likely to receive through the labors of this committee, will strengthen the hands of master mechanics who are laboring to have their locomotives designed properly for the work they have to do, and the material provided for doing it.

A Runaway Train.

A most singular and what might have proved a terribly fatal accident occurred last night to the Baltimore & Ohio Cincinnati and St. Louis express, on the Cheat River grade, the other side of Rowelsburg, W. Va. After the train left Terra Alta, a sudden jerk of the engine broke the coupling between the mail and baggage cars. The engineer did not notice it, and slowly but surely pulled ahead, leaving the baggage car and four coaches behind.

The trainmen on the cut-off section were also unconscious of the accident for some time, as there is no stop between Terra Alta and Rowelsburg, and they were all in the rear of the train. Presently the broken section began to show unusual speed as it shot down the 30-mile grade, both steep and winding. The passengers became terror-stricken. Investigation showed the engine and mail car gone and the rest of the train plunging down the mountain side at lightning speed. Pandemonium ensued. Women screamed and men turned pale. By the time the situation was realized the train was making nearly 80 miles an hour. By a desperate effort the train was stopped at Tunnelton after running 20 miles. The engine ran to Rowelsburg, 30 miles, before the engineer discovered that it had lost a part of its train. The engineer ran back, fearing that a tragedy had occurred, but was greatly relieved to find everything in good shape at Rowelsburg. The train arrived in this city an hour late.

The above intelligence was telegraphed from Cincinnati Feb. 16. How near the accident came to being another railroad disaster is apparent to every reader. It is also equally apparent that the accident could not happen on a train equipped with an automatic brake. The question is, how many bad accidents must there happen through the defects of their straight air brake before the Baltimore & Ohio Railroad Co. will be induced to give the traveling public the safety of an automatic brake.



WEBB'S FORM OF BLAST PIPE.

Regarding the device illustrated in the cut, Mr. F. W. Webb, locomotive superintendent of the London & Northwestern Railway, writes us: "In the National Car and Locomotive Builder I notice a discussion on various forms of blast-pipe. As it may be of interest to your locomotive friends in America to know what we are doing here, I inclose you a tracing of a form of blast-pipe that I have been lately trying, which gives us very good results and shows a saving of fuel over the old form. You will notice that I have opened out the blast-pipe and fixed in the center what our men have aptly christened a 'torpedo,' which directs the blast so as to fill the chimney, and at the same time I cut the blast-pipe down 7½ inches shorter, and lengthen my chimney inside the smoke-box, as shown."

Means of Promoting Safety in Railroad Operating.

Never in the history of railroad operating has the first three months of a year proved so fertile of terrible railroad accidents as the first three months of 1887. The last year had scarcely passed away, leaving the heart-rending record of the Rio holocaust fresh on the minds of the traveling public, when they have been distracted and distressed in rapid succession by the horrors enacted at Tiffin, White River Bridge and Bussey Bridge. These calamities make terribly conspicuous marks on the accident record of the year, and obscure by their prominence the miseries of smaller disasters, but without them the smaller accidents that have happened since the year began have been numerous and serious enough to give the first quarter a sanguinary character. Following the superstition that misfortunes never come singly, we might conclude that the close proximity by time of the numerous fatal casualties was merely accidental, but those who insist on seeing a close relation between cause and effect are not likely to give the railroad companies affected the benefit of the excuse that bad luck was responsible for the accidents.

The business of transportation has developed with wonderful rapidity on many of our railroads of late years, but in nearly all cases the application of appliances calculated to promote the safe operating of numerous trains moved at high speed has fallen far behind the rights and requirements of traffic. When railroads ran only a few trains daily, and these were moved at a low average speed, there was no great danger in depending on the intelligent care and vigilant attention of trainmen to do the operating safely, but with high speed and numerous trains, all practical appliances that skill has perfected and ingenuity devised ought to be applied to aid intelligence and vigilance in the prevention of accidents. The introduction of perfected mechanical appliances to promote safety in operating railroads is highly important, and railroad companies that neglect to provide every means calculated to prevent accident should be held to strict account, but something is needed from the public to make railroad operating moderately safe that is now habitually neglected. Fires started by stoves used for heating cars have added such appalling terrors to the horrors of recent accidents that public sentiment has been diverted to a false issue. The prevailing cry now is, the dangerous stove must go, when the people ought to be insisting that greater care and more elaborate safeguards must be introduced to prevent the accidents which permit the stove to do its frightful work. Automatic brakes, interlocking switches and signal appliances, and methods of operating that keep trains on the same track a certain distance apart, are all very important, and their use ought to be demanded where safety requires; but the highest perfected apparatus or systems will fail unless they are controlled by men who feel the responsibility reposing upon them to prevent accidents. Some of the worst accidents of the last six months have been due to the gross and culpable carelessness on the part of employés, yet all the punishment that has been meted out to the men committing wholesale homicide has been discharge from the employ of the company. Demagogues and enemies of all law and order find railroad companies a cheap object of senseless denunciation, and they have so perverted public sentiment in relation to railroad matters that juries habitually refuse to punish the blackest crimes where railroad companies are sufferers. Those who foster this sentiment and are influenced by it, fail to see that the traveling public are really the sufferers. The Rio accident was caused directly by the criminal carelessness of a brakeman in neglecting to close a switch. That man ought to be now in the penitentiary as a slight punishment for hurrying a crowd of human beings into eternity, and particularly as an example to other railroad men. But, instead of being in durance, he is at large, figuring as a hero. After passing through a trial that was a mockery of justice, he was set free, and was for some time exhibited in a dime museum in Milwaukee, as an object of curiosity or admiration! It is the degraded public sentiment which makes a disgusting exhibition of that kind draw visitors, that constitutes the most serious menace to human life and limb. Till the American public realize that the fundamental element of safe railroad operating is responsible railroad employés, and that it lies with the public themselves to hold the men to their responsibility, there is little prospect of railroad operating being made much safer than it is at present.

A. S.

Continuous Car Heating.

The subject of car heating was discussed for the second time by the Western Railway Club at the March meeting, and many valuable and interesting facts were brought out. An important feature about this meeting, and one which has distinguished it from all other meetings of a similar character held lately, was that the views expressed on car heating, and the discoveries reported thereon, were mostly those of practical railroad men. Before the existing discussion on car heating arose, railroad men generally supposed they knew all about the value and practicability of different systems of car heating; but the controversy has proved that they knew remarkably little about the value and cost of any method of car heating, and it is only now that accurate data relating to the subject is in the course of discovery. The information supplied by Mr. William Forsyth about the quantity of coal used in ordinary heaters was new to most of the railroad men present, and will no doubt form a basis for future calculations. If they were uncertain about the quantity of coal required to keep heaters going, they were more so respecting the amount of additional coal that a locomotive must use to supply steam for heating cars; but Mr. George Gibbs supplied reliable data which set that important question at rest. Till Mr. Gibbs, by experiment, measured the quantity of steam taken from the locomotive to heat cars under a variety of conditions, there was really nothing known about it. His work and investigations have transferred the question from the region of good or bad guessing to the region of accurate measurement. During the kind of of weather that will be encountered daily throughout the winter in all Northern states, and such as all roads in heating their cars must be prepared to meet, the five-car train in charge of Mr. Gibbs required 8½ per cent. of the heat which could be generated by the locomotive to keep them at a comfortable temperature. The tests demonstrated that the cars could be heated very evenly with steam from the locomotive, but the quantity of heat called for was considerably higher than the friends of the continuous system thought was necessary. It is about four times the quantity that Mr. John W. Cloud testified would be required. On the whole, the continuous method of heating railroad cars has gained decided advantage by the records kept of the train equipped with the Martin system on the Chicago, Milwaukee & St. Paul Railroad.

The Western Railway Club performed a highly creditable act in passing the resolution requesting railroad companies to thoroughly investigate and experiment with systems of continuous steam heating. The subject cannot be shelved any longer, and none will derive so much benefit as railroad companies from a systematic effort to show the exact value of improved methods of car heating. The traveling public have decided that the stove must go, and if railroad companies and their representatives do not quickly display a disposition to provide a safe substitute, the legislators of the various States will show what they know about car heating, and lead railroad companies into a tangle that will discount even car coupler legislation.

Boiler Inspection.

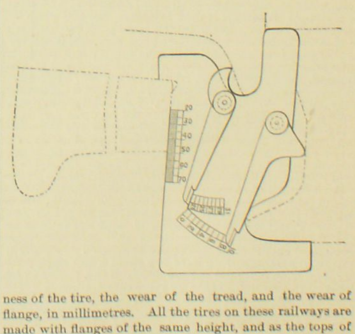
Locomotive boilers, as a rule, are remarkably free from disastrous accident, but several explosions lately have emphasized the fact that safety can only be maintained by eternal vigilance. The subject is of such immediate importance to railroad men that we gladly note everything we learn about systematic efforts made by the officers in charge of motive power and machinery to detect deterioration in boilers, and to provide remedies that are calculated to prevent accident. The mechanical department of the Union Pacific Railway have recently issued a small pamphlet, giving rules and instructions relating to special inspections of steam boilers, which shows that the officers of that road are alive to the vital importance of the subject. The practice of daily inspection, previously in force, is not interfered with by the new rules, which merely provide for means of carrying out increased precautions against accidents. Every division master mechanic is required to nominate one or more boiler inspectors, who shall be mechanical engineers, well qualified from practical experience and skilled in the use and construction of steam boilers and their appurtenances. Properly qualified men being nominated, they shall be appointed by the superintendent of motive power. Their business will then be to make general and special reports of all steam boilers belonging to the company, and report their observations to the superintendent of motive power. All the plant necessary for making thorough inspection will be provided. Making periodical examinations of all steam boilers by competent inspectors increases the operating expenses somewhat, but we do not know any line of expenditure where the returns for the outlay are likely to be more certain.

Weak Bridges.

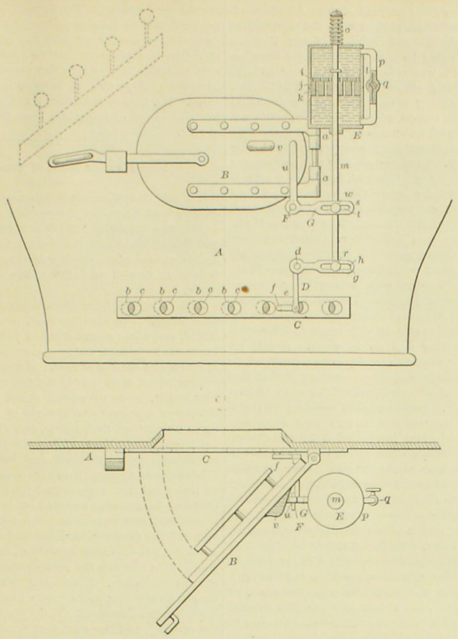
It is stated that several railroad companies have issued orders for their locomotive engineers to reduce speed in passing ever all bridges over a certain length of span, the disasters at White River Junction and at Roslindale having directed attention to the danger of weak or unprotected bridges. Precautions of this kind are very proper, but it would be better to replace or strengthen weak bridges with structures competent to bear any strains of train operating. A railroad that can be safely operated only by reducing the speed of trains in passing over all bridges gives unmistakable free advertising against itself, and persons solicitous about their own safety are likely to choose other routes when traveling. In respect to the Roslindale disaster, it is passing strange that the Railroad Commissioners of Massachusetts knew so little about the reported weakness of the bridge that went down. At the best, it was a series of patchwork, and its condition was likely to attract the attention of a competent inspecting engineer. It is generally understood that the Massachusetts Commissioners constitute "a guide, a buckler, an example" to all other boards of the same ilk; but the supervision they seem to exercise over the condition of bridges looks to be of the stereotyped kind, where the examination is made from the inside of a palace car run at ordinary train speed.

Device for Measuring Wear of Tires.

The engraving represents a device used on the Danish State Railways for measuring the wear of tires. It is made of thin steel plate $\frac{1}{16}$ inch thick, and measures the thick-



ness of the tire, the wear of the tread, and the wear of flange, in millimetres. All the tires on these railways are made with flanges of the same height, and as the tops of the flanges and the inner end of tire section are subject to little or no wear, the instrument always has two original points upon which to rest.



AUTOMATIC AIR SUPPLY REGULATOR.

Numerous admirable smoke-preventing devices have been invented for locomotives that acted by admitting the quantity of air above the fire necessary for effecting complete combustion, but none of them have ever maintained a popular hold on locomotive practice, principally for the reason that they admitted air at times when it was not required, and this had the effect of cooling down the fire-box without doing any service to overbalance this cause of loss of heat. In the combustion of bituminous coal a supply of air above the fire is an advantage for a short time after fresh coal has been thrown in and the hydro-carbon gas is passing off, for that compound is liable to escape unconsumed unless the oxygen reaches it from above; but when the upper portion of the fire becomes incandescent, less air is needed, and the great weakness of smoke-preventing devices has been that no means of regulating the air to suit the requirements was provided. The device illustrated herewith was devised by Mr. Frank C. Smith to meet this requirement, and make the supply of air above the fire automatic.

The invention consists of a cylinder filled with oil or other liquid in which a piston works that operates the dampers for opening and closing the air openings above the fire. On opening the fire-box door *B* the lug *v* strikes the bell-crank *u*, which results in pulling the piston rod *m* down, which movement by means of the bell-crank *D* opens the sliding-valve *C*, bringing the holes in it opposite those in the leg of the boiler, thus allowing fresh air to enter. The piston has holes through it, with a flat plate valve on top of it with holes also which are not co-incident with those in the piston. When the piston is pulled down the valve raises, allowing the oil to pass through to the upper part. When the fire-box is shut the reaction of the spring *o* pulls up the piston and closes the damper. The time of this movement is of course regulated by the passage of the air through the cock *q*, as it cannot pass through the valve and piston, and the period of air admission can be lengthened or shortened according to the quality of coal used and the kind of firing that is practiced.

The application of some device of this kind that will act without constant watching seems the only way to have the supply of air regulated, for enginemen will not give the matter their attention, and they cannot be expected to do so considering the numerous new duties that are constantly imposed on them. The inventor of the regulator has good authorities behind him, whose views encourage invention in this direction. The famous engineer, Mr. D. K. Clark, says: "Only two methods present themselves by which the supply of air and this want of the furnace can be made to correspond; either both must be made constant and regular, or the fluctuations of one must be made to coincide with those of the other." On the same subject, Professor O. J. Lodge, says: "Smoke combustion has been attained by the admission of an extra supply of air at a certain point of the flame, so that none of the gas may distil over unburnt, but that all may meet with a due supply of fresh air unsophisticated by passing through red hot coke and there be deprived of its active element. Hence attempts have been made to proportion the supply of air to the supply of fuel, and to allow for the rapid evolution of gas which goes on directly fresh coal is injected. This can be done in two main ways; first, by making the air supply intermittent in quantity to suit the intermittence of stoking, extra air being admitted every time a fresh shovel of coal is thrown in and for some time afterwards."

Rules Governing the Use of Brakes.

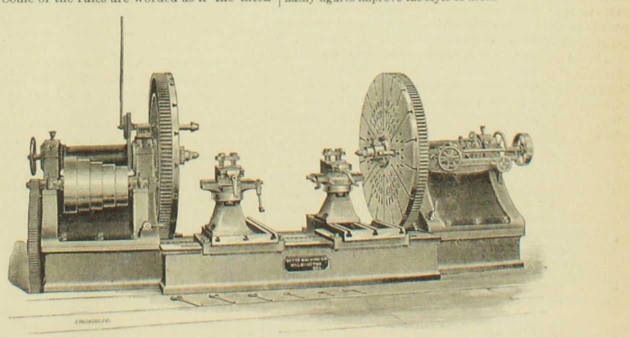
Mr. G. W. Cushing, superintendent of motive power of the Northern Pacific Railroad, has compiled a small hand-book of rules for the instruction of engineers and other employés who have to handle the brakes used on the road. The rules fill thirteen pages of a book convenient for the pocket, and are noteworthy for clearness of expression and for having important information stated in brief compass. Automatic air brakes are very extensively used on the Northern Pacific for freight as well as for passenger service, and it is important that all trainmen should be familiar with the brake mechanism. Practice in handling the brake for years has demonstrated what difficulties are most commonly encountered by trainmen in using the brake, and the rules have been framed to help over these difficulties. Some of the rules are worded as if the intention was to make simplicity simple, but that can hardly be overdone. Careful attention is devoted to explaining the proper position of the handles that operate the cocks regulating admission of air into different pipes, and explanations are given of what happens when the handles are turned in different directions. It might be supposed that nowadays no trainman should need detailed directions about how to cut air off from a brake cylinder, yet it is not very long ago that the writer saw trainmen disconnect the brake levers to release a brake, because they did not know how to shut off air from the triple valve which got out of order.

The rules give plain directions about changing from automatic to straight air, and makes these two conditions of operating air brakes easily understood. The operation of the pressure-retaining valve is explained so that any trainman who has read the book carefully could attend to the valve if he had not seen the work done before. Full directions are given respecting the points to be attended to by trainmen and engineers in the making up of trains and attaching engines to the same. Changing of engines is made the subject of distinct instructions; and the trainmen are directed how to proceed in the event of the train breaking in two. The engineers receive a great many special instructions about the care of the air pump and other brake mechanism, and about the different details of brake operating. Among the other subjects treated are driver brakes and water brakes, lucid and essential rules being laid down for the operation of both these aids to the control of trains. The book is quite interesting to read and does not contain a superfluous word. We are very much mistaken if making the trainmen familiar with these rules does not effect a marked improvement in the care and operation of power brakes on the Northern Pacific Railroad; although the trainmen on that road have always been above the average in the knowledge they display of brake mechanism.

Arcus's Hand-Car Hoist.

In the car shops of the Illinois Central Railroad, in Chicago, we recently examined an ingeniously contrived and much required improvement on hand-cars. The inventor is Mr. Sinclair Arcus, one of the workmen employed under Mr. Snow, the master mechanic of the shops. Those familiar with track work know the importance of having the means of moving a hand-car quickly from the track to be out of the way of approaching trains. The invention consists principally of a standard, which can be pushed downward below the middle of the car, raising up the car as if on a hoisting jack. The standard being exactly in the middle of the car, the latter can be readily swung round when resting on the standard, and can therefore be run readily off the track. The standard acts like a turn-table and hoist-jack combined. The apparatus for operating the standard is very simple, and the inventor holds that one man can remove from the track a hand-car loaded with 800 pounds of material. The Illinois Central are going to have the attachment put upon all their hand-cars, which is the best testimony as to what the track department think of the invention.

"With few exceptions," says a veteran observer, "illiterate and half-educated persons use more big words than people of thorough education. It is a very common but a very egregious mistake to suppose that long words are more genteel than short ones—just as the same sort of people imagine high colors and flashy figures improve the style of dress."



Seventy-Nine Inch Double Driving Wheel Lathe.

The engraving represents a 79-in. double driving wheel lathe, as made by the Betts Machine Co., Wilmington, Del. It is a most efficient tool for turning driving wheels for locomotives. The bed-plate is of such shape as to always bring the pressure of cut within the bed surface, and to insure rigidity to the slide rests, the front of the bed-plate is raised thereby, making the rests shorter and stiffer. The saddles are of such forms that when turning the largest wheels, the cutting tools can be placed directly in front of the treads, thus reducing the overhang of tool to a minimum. In this lathe a pair of drivers on their axle can be taken from under an engine, with crank pins in place, and both journals returned at one time. The machine with two face-plates enables both tires to be turned at once, or the hub of one while turning the tread of the other. Feeds are obtained from rock-shaft overhead, and can be operated to equal advantage in all directions by power. The spindles of both heads are adjustable by hand; the cone pulleys have 5 speeds for 5 inch belt; it is very powerfully geared, giving 10 changes of speed: the distance between the face-plates is 8 ft. 6 in. For convenience, a quartering machineis attached to one of the heads for boring crank-pin holes while wheels are in place.

NATIONAL CAR LOCOMOTIVE BUILDER

PUBLISHED MONTHLY

BY

R. M. VAN ARSDALE,

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EDITORIAL ANNOUNCEMENTS.

Advertisements.—*Nothing will be inserted in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *The editorial department will contain our own views and opinions; and the rest of the reading matter, aside from advertisements, will be such as we consider of interest to our readers.*

Contributions.—*Articles relating to railway rolling stock, construction and management, and kindred topics, by those who are practically acquainted with these subjects, are especially desired. Also early notices of changes in railroad officers, organizations and names of companies.*

Special Notice.—*As the* CAR AND LOCOMOTIVE BUILDER *is printed and ready for mailing on the last day of the month, advertisements, correspondence, etc., intended for insertion, must be received not later than the 25th day of each month.*

The Interstate Commerce Commission.

The duties to be performed by this commission, as prescribed by the new law, are likely to be arduous and perplexing, and it is well that its members are prohibited from engaging in any other business or employment while in office. For the first time since the advent of railroads in this country, a federal law has been enacted for the regulation of railroad Interstate traffic in all its multitudinous details. It would be surprising if such a law should not contain ambiguous clauses, framed as it has been by men whose knowledge of the science of transportation as at present developed is too limited to enable them to deal intelligently and wisely with its intricacies and complexities.

For a number of years it has been evident that a law of Congress for the regulation of railroad traffic would sooner or later become a necessity. The present one is admittedly crude, but it is well perhaps that it has been enacted. Its defects will be revealed by its enforcement and will lead to something better. A strict compliance with its provisions, so far as they can be understood, will have the effect of educating law-makers and people, as did the Granger legislation, to perceive and correct many wrong impressions in regard to railroad transportation.

There are several features of the new law that will meet with popular approval. It provides for a government commission with plenary authority for obtaining information pertaining to railroad management that may be considered necessary to enable the commission to perform its duties, and to make an annual report to the Secretary of the Interior, to be transmitted to Congress. This requirement, if faithfully fulfilled, will supply a want which has increased in urgency with the extension of railroads. It is safe to say that this provision of the new law will not speedily be wiped out or become a dead letter. The law also gives the commission discretionary power to require all railroad companies to make annual reports at such time and manner as may be prescribed, and to give specific answers to questions upon which information may be needed, the reports to cover such details in regard to financial condition, operation and management as be may required, so that he returns will be approximately uniform and capable of being systematically tabulated. The commission has also discretionary power to require, as far as may be considered practicable, a uniform method of keeping accounts. Practical uniformity in these respects, enforced by government authority and supervision, would be of great advantage in the compilation of reliable statistics to take the place of the loose, misleading guess-work with which our railroad manuals are almost necessarily encumbered.

Railroad Clubs.

The success of the Master Car-Builders' and of the Master Mechanics' Associations has demonstrated the advantages to railroad men and to railroad interests that were to be derived from railroad men meeting together periodically and talking over matters that all are mutually interested in. The impression that smaller bodies of railroad men meeting at more frequent intervals than once a year might also benefit those who attended and the interests they represented, led originally to the formation of railroad clubs, and there is now every indication that all railroad centers will soon have their railroad clubs. All the readers of railroad literature are familiar with the proceedings of the New England Railroad Club and of the Western Railway Club, which may be taken as the most vigorous and successful in the country, but they are going to have many rivals directly. A club has been formed in Buffalo with a promise of strong membership in numbers and ability, and there is no reason why a good club should not flourish in that city with its numerous railroad men. We are also advised that clubs have been formed in Omaha and in Tacoma, W. T. In these smaller railroad centers the membership is likely to be limited, but there is no reason why at such places the railroad club should not form the center for intellectual improvement and amusement, and occupy a position analogous to that held by the Mechanics Institute of the past generation. With the tie of railroad interests to bring members together they could discuss or investigate any subject the members were likely to be interested in, railroad subjects getting the preference.

We have been repeatedly consulted about how railroad clubs should be established and conducted. We think the best plan is to leave the gates of admission as wide open as possible, get together and go to work. Nearly all Americans know how meetings ought to be conducted, so there is no difficulty in getting the proceeding held in formal order. The less of a "constitution" the club is harnessed with the better. Decide at each meeting what the business of the next meeting will be, and have some one appointed to make a formal introduction of the discussion. This, our experience leads us to believe to be the most important feature about the successful management of a club. If one man has the responsibility of introducing a subject put upon him in advance, he is likely to be thinking it up, and the chances are that he will put life into it at the opening and a lively discussion will ensue. When, on the other hand, a subject is left to be opened at hap-hazard, no one is prepared to present it in good shape. Member after member refuses to make a beginning, a damper is thrown over the proceedings at the start, an unprofitable evening is passed and it presages a thinner attendance at the coming meeting. Many men who make valuable members of railroad clubs have not had experience enough in addressing public meetings to make a good opening address without notes. For the benefit of these men and the clubs generally, a member ought to be permitted to open a subject with a written address if he so desires. Whatever way a subject may be opened, if the salient points are clearly presented, the inducement will be given for others to express their views, and thus lead to a cordial exchange of sentiment, experience and opinion, and the mutual benefit to be derived therefrom.

A Voice from the Car Stove.

For some time after the terrible accidents that brought the subject of heating railway cars safely into conspicuous prominence there was no word uttered publicly in favor of the stove. But the stove has many friends. It is a simple way of heating a car; it is convenient in many ways; it has the merit of an established institution, and the greater part of day cars are equipped with weak cast-iron stoves, and to throw them aside is to entail serious expense on all railroad companies. These are good and sufficient reasons for the stove having numerous defenders.

AT the last meeting of the Western Railway Club, the friends of the stove were heard from, and able pleas were put forward in its defense. Mr. Jacob Johann, whose words on all mechanical subjects are always listened to with respectful attention, showed how he had made the stove a fairly safe heater in the past, and Mr. John Hickey, a thoroughly practical railroad man, made out a good case for making the stove safe in the future. We are afraid, however, that even these eloquent advocates of a reformed stove will fail to secure a large following, for the reason that the stove has fallen into such disrepute that few travelers will believe that it has any redeeming qualities as a car heater. If the great mass of officers in charge of cars had been encouraged to follow, and had adopted, the policy pursued by Mr. Johann, with the result that the stove was strengthened and its dangerous attributes eliminated, there would now be no agitation for its removal. The railroad companies received many impressive warnings that the cast-iron stove was a potential danger always threatening to become destructively active. But the greater part of them paid no heed to the warnings. They continued using the poorest kind of stoves, they continued to stuff their floors full of shavings so that the fire thrown broadcast from broken stoves should have plenty of kindling to start a conflagration with, and now the day of stove reform is past, and the people demand a root and branch revolution in methods of heating. Who can blame them?

Mr. Hickey is an enthusiastic advocate of the stove, and he holds the peculiar position among railroad men of favoring the common radiating stove to the exclusion of the improved forms of heaters where a stove is employed to heat water that is circulated through pipes. Every good word that can possibly be said in favor of the stove appears to be expressed in Mr. Hickey's communication, but it is doubtful if any one not wedded to the stove on account of first low cost will see any new reason why it should be retained. We cannot see why an improved heater should be suitable for heating sleeping cars, and yet be badly adapted for ordinary day coaches. If it is a good thing in one place, it must be good in the other, and the only real objection to it in day coaches, smoking cars and baggage cars is, that it is more costly than a radiating stove. Mr. Hickey is leading a forlorn hope, and it is well for the cause of humanity that he has few active followers.

The Monitor Roof of Passenger Cars.

It is said that there are now running on the Boston & Albany road a number of new passenger cars with rounded or arched roofs instead of the usual raised or deck roofs; and it is also said that the Bradley Car Works are building several cars of the same or a similar construction for the Boston & Lowell and the Chicago & Eastern Illinois roads.

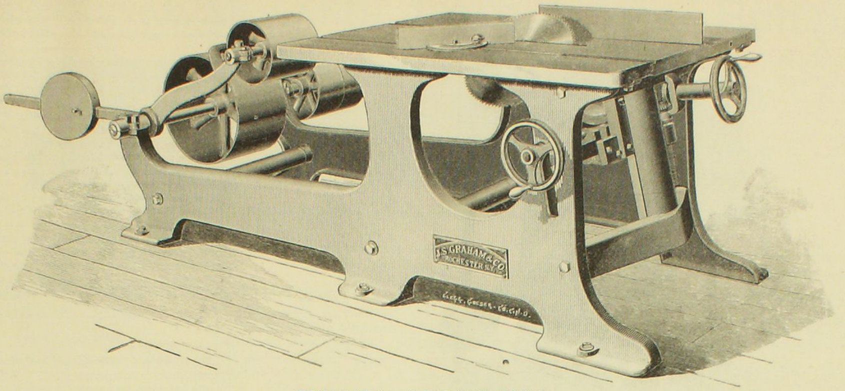
This departure from present practice is not strictly an innovation. The monitor roof, or deck, as it is usually called, came into vogue some 25 years ago, and since then has come to be regarded as almost an indispensable feature of American passenger cars. It was thought to be a great improvement upon the old flat-top car, by affording better ventilation, more over-head room, and a means for the display of a more tasteful style of ornamentation in the way of moldings, deck-lights, etc. Hints have been thrown out from time to time within the last few years that its advantages were overrated, and that it was getting to be old-fashioned and ought to give way to something better. At first sight it may seem that the change which has been initiated by the above named roads is a progression backwards, but in reality it is not a retrogression but an advance. The monitor deck has had a pretty good run, and when once the tide sets against it, it will not be likely to come back; and this for several reasons. Its construction is bad in principle. It necessitates the use of iron carlines shaped to conform to four ugly angles of the roof to give it stiffness and support. These carlines are carefully kept out of sight, and the roof, as a whole, appears to be without requisite strength; and, considering the quantity of material used, it is certainly weak, the strength being all in the carlines which have to carry a weight out of proportion to their size. A certain effect is produced in mere appearance and display. The roof is made to look as if held up by magic, but architecturally it savors of deception and trickery.

We hope the new departure will be sustained. There is no danger of getting back to the primitive flat-top. The arch can be made to meet every requirement in respect to ventilation and lighting, and at the same time be very much stronger and lighter, more attractive in the matter of decoration, and in case the side walls of the car body are raised to correspond with the curve, as of course they must be, a great deal of space will be added to the interior. To what extent this increase in the height of the car sides, including hoods and ventilators, would be interfered with by bridges, tunnels and station platform roofs, we cannot say, but our impression is that little trouble is to be apprehended on that account.

No Danger of a Timber Famine.

The alarm at the prospect of a timber famine is not as great as it was. The newspapers, at all events, do not contain so many frightful estimates of the decrease of forest area and the growing consumption of timber, and there seems to be good reason for it. The census figures are assumed to be approximately correct, because they are official in a certain sense, and the statements made at the last session of the American Forestry Congress are also supposed to be as correct as any round numbers are likely to be that run up into thousands of millions. We strongly suspect, however, that the figures from both these sources are wide of the mark, and fall very far short of representing the real timber resources of the country. They are evidently derived to a large extent from parties who have an interest in representing the supply as rapidly diminishing, and the consumption as increasing at a corresponding rate, to say nothing of the great variation in the current estimates of the available supply in any particular State or section of the country, a variation which in many instances may be owing to a desire to influence the lumber market, or to exaggerate the natural wealth and resources of localities and sections.

This view of the situation has been suggested in part by an article which appeared some weeks ago in the *Manufacturers' Record*, giving an account of "The Timber Wealth of Georgia," the writer of which is a little inclined to "boom" things and revel in figures. If the half of what he says is true, and if the contiguous States of the South are anything like as rich in the extent and variety of their timber products, the apprehended famine is as yet a long way off. According to the writer, the northern portion of the State abounds in hardwood timber of every description, two counties alone containing no less than 230 varieties. Along the Atlantic coast there is a continuous belt of live oak 125 miles long, and containing over fifty per cent. of this timber now standing in the United States. The cypress forests in the central and southwest-



COMBINATION MITRE SAW TABLE.

The engraving represents the latest improvement in a combination saw bench, which is particularly adapted to use in casket works, furniture, piano, sash and blind factories, car, picture frame and pattern shops, or any establishment where plain, bevel or mitre sawing is required to be done in a rapid and perfect manner. It is designed with special reference to strength and simplicity, and will be found to meet the wants of the trade in the most satisfactory manner.

The whole machine is constructed of iron and steel, and the workmanship is first-class. The table is one piece, 4 ft. by 3 ft., accurately planed and bolted firmly to the frame. It is fitted with the necessary groove slides for ripping and cross-cutting gauges. It is also provided with removable piece, allowing the use of wobble saws, dado heads, etc.

The saw is raised and lowered to any desired height by the hand-wheel in front of the machine, and can be set to any miter or angle up to 45 degrees by turning the hand-wheel at the side of the machine. An accurate index, with the degrees of angle, is at the front of the machine in sight of the operator.

The table is provided with improved bevel slitting gauge and cross-cut or mitering gauge, which, in connection with the angular adjustment of the saw, enables the operator to get every conceivable plain or double miter ever required. The top of the saw table is the pivot that the saw swings on, hence there is no necessity for sliding or tipping table for any purpose. The table is slotted for and furnished with a 16-inch cross-cut saw.

The countershaft and tightener are a part of the machine, and can be run wherever a belt can be brought to them. The tight and loose pulleys are 12 by 6, and should be speeded to suit the saw.

Manufactured by J. S. Graham & Co., Rochester, N. Y.

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ern part are so dense in some places as to be almost impenetrable to the lumberman. But the largest single element of Georgia's wealth in timber is the belt of long-leaf pine running through 73 counties and scattered elsewhere all over the State. There is also plenty of cedar in certain localities. Assumed estimates are given of the aggregate number of feet of hard lumber in the State, but as they are merely conjectural we omit the figures. Georgia is without doubt a big lumber State.

Sawdust Carvings.

An English paper speaks of a newly discovered process for producing perfect and durable imitations of wood carving, which rival in appearance the best high class hand-work. The material used is compressed sawdust, overlaid with veneers of various kinds of wood, and as the work is done by machinery, the articles—panels, friezes, medallions, etc.—cost only about one-twentieth as much as those made by hand. Artificial wood ornaments made of sawdust have been in use in the United States a dozen years or more, and were at one time used to some extent in the interior finish of passenger cars. The designs were colored in imitation of mahogany and other cabinet woods, instead of being coated with veneer.

Cheap, machine-made imitation devices, however perfect may be their decorative effect, can never take the same art rank with genuine hand-work. Whatever merit they have is in the cleverness of the imitation. No matter how perfect the product of the machine may be, its perfection loses its charm when it is discovered to be a piece of labor-saving economy. Its value artistically will be determined by the extent to which the process of production has been cheapened by mere mechanism. Machine work is, nevertheless, a good thing in its sphere, but it does not include the sphere of art. Utility has practically nothing to do with mere decoration. In high art, nor in low art, for that matter, unless it is very low, there can be no division of labor; and no really effective decorative work is possible unless the producer takes a pleasure in the doing of it, and an honest pride in it when it is done. This, a machine is incapable of doing.

A. Whitney & Sons, of Philadelphia, announce in a circular that they have perfected improved methods of making cast-iron chilled car wheels, and claim that by the use of their patent contracting chills, the mileage of their wheels will be materially increased, because they secure accurate roundness, uniformity of size, increased depth of chill, uniformity in depth of chill, and greater density and durability of chill. They also use a mixture made of the best charcoal irons, and they have recently made important changes in patterns. A form of guarantee has been adopted which extends to quality, diameter, circumference, roundness, trend, plate, chill, strength and mileage.

Meetings and Conventions.

Association of Railroad Superintendents: Brunswick Hotel New York, April 12.

Car Accountants' Association: Annual Convention, at Augusta, Ga., April 19.

Freight Brake Tests, at Burlington, Ia., May 9.

Master Car-Builders' Association: Annual Convention, at Minneapolis, Minn., June 14.

Railway Master Mechanics' Association: Annual Convention, at Minneapolis, Minn., June 21.

A New Car Chair.

The Scarritt car chair is rapidly making its way into favor among the railroads in the West and Southwest, and those who have enjoyed the pleasure and luxury of riding on these chairs are all ready to testify to their comfort and convenience. We understand that the Pullman Company, although owning several patents for car chairs, have now seventy cars equipped with the Scarritt chair. The Missouri Pacific have just contracted to put the chair in eighteen cars, the largest order ever given, and the Wabash; the Gulf, Colorado & Santa Fe; and nearly all the railroads in the West and South have ordered some of the chairs. The chair is noted not only for comfort but for strength, and its substantial fastenings, which were recently severely tested in an accident at Dunbar, Neb., where a train went down an embankment, and a Pullman car having this style of seat was so much damaged that it had to be entirely rebuilt; yet the seats retained their position and were but little damaged. The seat is built by the Scarritt Furniture Company of St. Louis.

Indurated Fiber Ware.

We have received from the Indurated Fiber Co., of Lockport, N. Y., some specimens of their manufacture in the form of spittoons adapted for use in railway offices and stations. They are made of wood fiber, pressed and indurated, are light, strong and durable, impervious to liquids, hot or cold, acid or alkaline, and are neither varnished nor painted. Various other articles, such as pails, buckets, etc., are made by the company from the same material. They are pressed out in one piece without joint or seam, and are not effected by extremes of weather. The fire pail manufactured by this company has been recommended by the Chicago Board of Fire Underwriters as better and more economical than the wooden pail. The company has opened an office at 19 Wabash avenue, Chicago, which will be in charge of Mr. A. H. Prescott, formerly of the grocery house of Reid, Murdock & Fischer.

New Publication.

Report of the Proceedings of the Twentieth Annual Convention of the Master Car-Builders' Association, held at Niagara Falls, June, 1886. This report is very full and complete and has been carefully edited. The letter-press, illustrations and general arrangement of the contents are excellent. The regular proceedings occupy 180 pages, 67 of which are filled with the discussion of the Rules of Interchange. Heretofore these discussions have been omitted in the annual reports, and only the rules as revised inserted. The report of the Executive Committee on the Buffalo car coupler tests is accompanied with tabulated descriptions, showing the several classes of couplers that were tested, the construction of each coupler and the results of the tests. The rest of the volume, consisting of 100 pages, is devoted to collateral matter—letter-ballots, minutes of meetings of the Executive Committee; standards and forms of construction that have been adopted by the Association; the revised Rules of Interchange; Constitution and By-Laws; Committees for current year; List of Members, and a very complete index. In addition to the numerous illustrations in the body of the report, including cuts of 42 car couplers, there are 14 inset plates at the end of the volume, representing standards that have been adopted, and full details of the proposed standard truck for freight cars of 40,000 lbs. capacity. The report contains a mass of reliable information in regard to the organization, membership, the work already done by the Association, as well as its prospective work, and will be found extremely useful for reference.

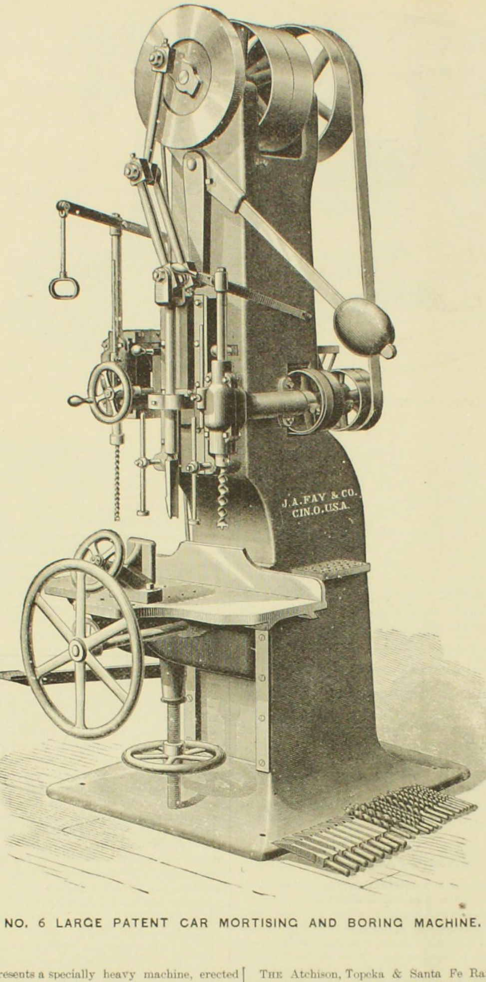
Our Directory of Railroads.

In order that this directory may be as reliable as possible, we send circulars from time to time to all the roads in our list, with the request to report needed corrections. These circulars, as a rule, receive prompt attention. Errors of omission or otherwise are reported to us, and in cases where no corrections are needed, we are so informed. There are, however, a comparatively small number of roads which make no reply to the circulars, even when they are repeatedly sent, nor do they let us know whether the record as it stands is correct. In order to invite attention to this apparent neglect, we herewith append the names of such roads, with the request that the information we need may be furnished us, and that in case no corrections are needed, that fact should also be stated. The names of the roads from which no replies have been received are as follows.

Albemarle & Raleigh R. R.
Albert Railway.
Bangor & Piscataquis R. R.
Canada Atlantic Railway.
Central & Southwestern (Ga.) R. R.
Chicago & Eastern Illinois R. R.
Clarksburg, Weston & Glenville R. R.
Columbus & Western Railway.
Cumberland & Pennsylvania R. R.
Gainesville & Dahlongea R. R.
Georgetown & Lane's R. R.
Jacksonville Southeastern R. R.
Kansas City & Southern Railway.
Litchfield, Carrollton & Western R. R.
Memphis & Little Rock R. R.
Mont Alto R. R.
New Orleans & Carrollton R. R.
New Orleans & Selma R. R.
Norfolk Southern R. R.
Ottumwa & Kirkville Railway.
Pacific Coast Railway.
Pennsylvania Coal Co.'s R. R.
Pennsylvania, Slatington & New England R. R.
Philadelphia & Atlantic City R. R.
Pittsburgh & Castle Shannon R. R.
Rome (Ga.) R. R.
Springville & Sardinia Railway.
St. Joseph Valley R. R.
St. Louis & Hannibal R. R.
St. Louis & San Francisco Railway.
St. Martin's & Upham Railway.
Syracuse, Ontario & New York R. R.
Texas Trunk R. R.
Tioga R. R.
Tuckerton R. R.
Western North Carolina R. R.
Wicomico & Pocomoke R. R.

Information for use in the Directory should include track gauge and mileage, number of cars and locomotives, and the names and post-office address of general managers, general superintendents, division superintendents, purchasing agents, master mechanics and master car builders.

Messrs. E. Gould & Eberhardt, of Newark, N. J., have recently booked orders for their Automatic Gear Cutters (which are *entirely* automatic) from Potter Printing Press Co., Plainfield, N. J. (two machines); Brown Cotton Gin Co., New London, Conn.; Weed Sewing Machine Co., Hartford, Conn.; American Sewing Machine Co., Philadelphia, Pa.; Willets Manufacturing Co., Providence, R. I., and Stiles & Parker Press Co., Middletown, Conn. Sir William Armstrong, of England, recently received an 84-in. machine which is capable of cutting 2½ in. circular pitch in forged steel, 12 in. face with two cutters at one cut. Nearly one hundred of these machines are in successful use in Spain, France, Switzerland, Germany, England and other countries. The new Automatic Drill Press of this firm is built in four sizes and is highly approved for its effectiveness.



NO. 6 LARGE PATENT CAR MORTISING AND BORING MACHINE.

The engraving represents a specially heavy machine, erected from new designs, and adapted for the heaviest description of car and bridge work, being capable of cutting a 2½ in. mortise through a 12 in. timber.

It is constructed upon a hollow column of very strong section, having a broad base, upon which it stands firmly upon the floor, and with every part so attached to and supported on the main column that no attachments to the building are necessary. The driving pulleys are placed between the bearings instead of being overhung, as is the case with some machines, which adds materially to its capacity and power. The chisel bar has a perfectly graduated stroke, commencing at a still point above the extreme upper throw and working gradually down into the mortise, with little or no perceptible jar to the foot, under perfect control of the operator, without slides or levers, and with about one-half the joints usually employed in machines of this class. The bed will receive timber up to 17 inches square, and the chisel will beat a mortise to the center of 12 inches and 6 inches deep, or, by changing the face of the stick, it can be made to work clear through. The bed or table is supported on a central screw, by which means the thrust or blow of the chisel is terminated to the foundation, and does not fall upon the table bracket. It has two boring attachments, arranged in a novel and compact manner, one on a line with the chisel to bore for the mortises, which will bore to 10 inches from the center of column; also, an adjustable auxiliary boring attachment, for boring bolt holes, will bore 14-inch material. Both boring attachments are driven direct from the counter shaft in the machine. With each machine is furnished 9 chisels and 9 augers to correspond; sizes ¼, ⅝, ¾, ⅞, 1, 1⅛, 1¼, 1⅜, 1½ inches, also long augers for boring joint bolts, sizes $\frac{9}{16}$, $\frac{11}{16}$, $\frac{13}{16}$. Other sizes can be furnished, as may be wanted. Especial attention is called to the fact that every joint in the graduated movement is bored and turned, and is compensating, while there is not a piece that will not last years with care and skillful use. The very large numbers in use in the principal railroad and car shops of the country attest the value and character of the machine, which is warranted to give the highest satisfaction. The T and L pulleys are 16 × inches, and should make 275 revolutions.

Manufactured by J. A. Fay & Co., Cincinnati, O.

The Master Car-Builders' Club has presented to the family of Leander Garey, its late President, a beautifully engrossed and handsomely framed copy of the obituary resolutions adopted by the club at its January meeting.

The Atchison, Topeka & Santa Fe Railroad Co. have contracted for a number of the Van Beek Car Seats, manufactured by the St. Louis (Mo.) Reclining Car Seat Co.

Mr. H. A. Little, of New York, and recently General Sales Agent of the Concave Elliptic Spring Co., has severed his connection with that company.

Mr. H. Burkhart, so well known among railroad men for his advocacy of steel castings, has lately accepted the general agency for the Standard Steel Casting Co. His office is at 156 Washington street, Chicago.

The new shops for the manufacture of the Boies Steel Wheels, at Scranton, Pa., are now completed and in operation. A contract for one year has recently been closed with the New York, Lake Erie & Western, including the New York, Pennsylvania & Ohio line.

The Union Switch & Signal Co. have removed their office and works to Swissvale, Pa. (near Pittsburgh), where all communications should be addressed.

We have lately received some beautiful specimens of Atlas bronze in the form of paper-weights and cutters sent out from the Philadelphia Smelting Works. Several master mechanics and master car-builders who have examined the artistic specimens on our table, have assured us that the metal is quite as useful as it is ornamental, as they find the castings made from it are particularly sound and durable.

Some very successful experiments were made a few days ago at the Union Depot yards, at New Haven, Conn., for the purpose of testing the capacity of the Whitner Automatic Safety Brake for the instant stopping of trains in case of necessity. No attempt was made to actually derail a train or break an axle, but a much less serious dislocation of the running gear than would be caused by either of these occurrences served to bring a train of two passenger cars to a stop in about half a car's length.

The Phosphor-Bronze Smelting Co., of Philadelphia, have issued a new illustrated price-list of its products, including roll and sheet phosphor-bronze, wire for telegraph and telephone purposes, wire ropes, wire cloth, nails, chains, pump rods, bolts, nuts and screws, sash chains, tools, castings, phosphorized anti-friction metal, etc.; also tables showing the difference between wire gauges, weight of phosphor-bronze wire and plates per 1,000 lineal and square feet, and also weight of bars and plates.

The existing demand for the construction of new freight cars has brought a very heavy volume of business to Drake & Wiers, of Cleveland, their asphalt car roofing being ordered for a large proportion of the cars contracted for since the year began. Among the roads which have recently ordered this roof, are the New York, Lake Erie & Western; the Buffalo, Rochester & Pittsburgh; the Lehigh Valley Railroad; the Detroit, Lansing & Northern; the Ohio & Mississippi, and a great many others.

The Universal Radial Drill Co., of Cincinnati, have issued a new illustrated catalogue containing detailed descriptions of the different drilling machines of their manufacture, showing their range and adaptability. The company is prepared to design and build any special or unusual machines of this class for special or extra heavy work. The catalogue also contains the names and address of 42 users of the company's machines, and a large number of testimonials. The company has been compelled to increase its plant in order to meet the increasing demand for drills of all izes.

Editorial Indiscretion.

The Knights of Labor start off with the proposition that, "An injury to one is the concern of all." Without discussing this, it is safe to assume that whatever tends to degrade technical journalism is to some extent an injury to all technical journals; and so, aside from the esteem we have always felt for our civil engineering contemporary of this city, the *Engineering News*, we deplore the performance of its new editor in the matter of the Forest Hill Bridge accident.

When Mr. Julian Hawthorne accused James Russell Lowell of lying, we ascribed his act to the bad company he was in. When a daily newspaper reporter violates all the decencies and humanities, we regret the sensationalism of the daily press. But when a hitherto respectable technical journal purloins property and brags of it; hastens to attack fair reputations on one-sided and partial evidence; writes an impudent letter to a deceased railroad commissioner of Massachusetts, offering unsought advice; and the delivery to him of property clandestinely obtained from the Boston & Providence Railroad; and, in short, displaying an ignorance and hysterical heels-over-headitiveness worthy of the "Morning Blatherskite," we are amazed at the folly of it.

In the case now under consideration there are mitigating circumstances, and ground for the belief that it was an accident and no indication of a policy. The editor who instigated the deed and tries to make people think that he thinks it was a good thing to do, is new to responsible editorship and is a man whose impetuous temper has caused his career to be a succession of brilliant failures. Doubtless he will in time learn that indiscretion in an editor is a crime.

Our Directory.

We note the following changes since our last issue. Our readers will do us a great favor by giving us prompt notice of any changes that may come to their knowledge or of any errors that may be noticed in our list:

Boston & Lowell.—E. P. Moulton has resigned his position a Master Mechanic of the Vermont Division.

Boston & Maine.—Geo. W. Hurlburt has been appointed Superintendent of the Worcester, Nashua & Portland Division, vice Charles Howard, resigned.

Central of New Jersey.—G. H. Griggs has been appointed Superintendent of Motive Power of Central and New Jersey Southern Divisions; and L. C. Brastow, of Lehigh and Susquehanna Division.

Kansas, Nebraska & Dakota.—This road is now a part of the Missouri Pacific system, and H. M. Fickinger has been appointed Superintendent of same.

Minnesota & Northwestern.—Wm. Patterson (late car department foreman of the St. Paul, Minneapolis & Manitoba) has been appointed Master Car Builder.

Minneapolis, Sault Ste. Marie & Atlantic.—Thomas A. Fraser has been appointed Master Mechanic, in charge of locomotive and car departments.

Missouri Pacific.—W. W. Fagin has resigned as Superintendent of the Central Branch Union Pacific Division.

New Haven & Northampton.—Stacy B. Opdyke has resigned his position as General Superintendent.

New York, New Haven & Hartford.—Charles P. Clark has been elected President, to succeed Geo. H. Watrous, who resigned on account of ill health.

Philadelphia & Reading.—W. G. Yetter has been appointed Superintendent of the Catawissa Division, including the portion of the Catawissa & Williamsport Branch from East Mahanoy Junction, Pa., to West Milton and the Milton & Treckow Branches. A. A. Hesser, Superintendent of the Mahanoy Division, will also have charge of the Catawissa & Williamsport Branch from West Milton to Newberry Junction.

St. Paul, Minneapolis & Manitoba.—W. T. Reed has been appointed Master Mechanic, in place of Thomas Downing resigned. Mr. Reed was recently on the Canadian Pacific. John A. Mayer has been appointed Superintendent of the Breckenridge Division, vice W. S. Kemp resigned, and C. Shields is appointed Superintendent of Montana Division.

Union Pacific.—O. H. Dorrance, Superintendent of the Nebraska Division, has resigned on account of ill health.

Wabash Western.—This the name of the new organization succeeding to the Wabash, St. Louis & Pacific.

Employment.

Wanted.—A Salesman to sell lubricating material to railroads—one who is acquainted with the trade. The advertiser is an expert in the manufacture of the goods, has good specialties and a well equipped factory. Will give the right man an interest, salary or commission. Address National Car and Locomotive Builder, 175 Dearborn street, Chicago.

Wanted.—By a first-class Ornamental Designer, a position as Assistant Mechanical and Architectural Draftsman. Would prefer a position in a railroad shop. Can furnish first-class references. Address "T-Square," office of the National Car and Locomotive Builder.